The Chemical Age

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Training the Coming Generation

THE lecture aptly entitled "Wanted—an intelligent youth," delivered by Dr. S. H. Tucker to the Andersonian Chemical Society, and reported in THE CHEMICAL AGE last week, raises many questions to which the answer is not immediately obvious. Dr. Tucker's point, if we do not mistake his meaning, is that an unduly high proportion of those who pass through the degree course of universities and technical colleges have not sufficient intelligence to rise to that position in the world which they should occupy; worse, they are in all too many instances unemployable in industry. That is a serious allegation, and it is the more serious because in some measure it is true. The products of our universities are widely distributed throughout the world, but the greater number of graduates become teachers. Thousands of these men are content to browse through the world, apparently without ambition, certainly without making a mark upon the affairs of the world around them—yet they are not only intelligent in the ordinary sense of the word, but frequently learned; learned with the knowledge acquired in books, not in the affairs of men. Similarly there are in industry many who seem always destined to play a subordinate role; who remain throughout their lives as junior chemists, plant operators and the like, although their training should fit them to be leaders of their fellows. If the names of the founders of the great chemical undertakings be passed in review it will be found that a high proportion of them were not trained at higher scientific teaching institutions, and that practically none of them had been through anything equivalent to a present-day degree course. Yet their successors, often their sons, have for the most part been highly trained, and the flourishing condition of the British chemical industry in a time of world difficulty does not suggest that they are men devoid of initiative, leadership and ability to handle practical affairs.

A few weeks ago the death was announced of Dr. Brittlebank, a doctor of chemistry and British Vice-Consul at Essen. He was interned during the war at Ruhleben and, during that time, remarked upon the different effect on character of the British and German educational methods. "I notice," he remarked to a fellow-prisoner, "a great difference between them. We, who have received a German education, are quite lost when removed from our normal environment and wander about like stray dogs looking for their masters. You, who have received an English education, set to work at once as if you had emigrated and proposed to found a colony." So long as that is the general effect of British educational methods, it is difficult to hold that there is much wrong with them. The British are colonists, administrators and pioneers. It may seem that too much book learning causes resolution to be sicklied o'er with the pale cast of thought, and undoubtedly there is a tendency for excessive concentration upon learning to encourage knowledge to be regarded as an end in itself, not as a means to an end. Lack of personal ambition is too often the reason for the apparent lack of success, and where ambition is absent, opportunity to acquire the necessary experience in the affairs of men is not sought. Consequently the symptoms deplored by Dr. Tucker become evident.

Unquestionably students are made to learn far more than they ought and infinitely more than they need. The inefficiency of book-learning is such as would never be tolerated in any industrial process. Dr. Tucker contends that it is better for students to learn less and think more. Facts are always to be found in their proper place—the text-book or work of reference—provided, and this is important, provided we know they exist. The aim in training students must surely be to acquaint them with the existence of facts and principles, and to be sure they understand them, and further to train the student to apply existing and future knowledge to the practical affairs of life. Unapplied facts are no better than unknown facts.

If we agree that lack of something, be it personal ambition or intelligence, creates a high proportion of trained men who are of little value in industry or anywhere else, what is the cause? Is it the fault of the training, or of the teacher, or of the individual, or of the employer? The system of training may be at fault as suggested by Dr. Tucker. There are many teachers who never should be teachers at all; mechanically they deliver lectures consisting of recitals of "facts" read from a text-book, but of the real leadership which they should give to the adolescent mind, they are innocent. Either it is beyond them or it is too much trouble. The profession of teaching should be raised to a higher plane altogether for on the quality of leadership in those early years depends the future of the human raw material of industry and therefore the future of industry. Nor can employers escape whatever blame there may be. Training is only half completed in the college; a most important half remains to be effected in the works. An employer who is careful of his employees' welfare has it in his power often to make from the most unpromising material, men who, by their experience, judgment and initiative, can be of the utmost value to him.

Notes and Comments

Science and the Railways

SINCE Brigadier-General Sir Harold Hartley took over the direction of the scientific research activities of the L.M.S. Railway there has been a clearer recognition of the vital contribution which the chemist makes to modern railway industrial efficiency. An energetic department has been gradually built up, and a new research laboratory has been established at Derby, equipped with the latest machinery and devices for carrying out research of a specialised railway character. The provision of such a laboratory marks an important stage in the relationship between scientific research and industry, and the occasion is to be fittingly celebrated by an official opening ceremony of a novel character next Tuesday. Lord Rutherford will declare the new laboratory open in the course of some after-lucheon speechmaking which is to take place in a special train conveying the guests from London to Derby. The speeches will be broadcast throughout the train, and the visitors will afterwards have an opportunity of inspecting the laboratory and some of the other establishments of the company. Few people realise the extent to which research enters into present-day railway administration. Sir Harold Hartley, however, has already told the chemical industry, through the medium of his paper on the railway transport of foodstuffs, at the annual meeting of the Society of Chemical Industry at Glasgow, last July, sufficient to show that the chemist is an indispensable servant of twentieth century transport. There is a great deal more than food transport to be studied at Derby, and we hope that from time to time those who work in the new research laboratory will be able to tell their fellow research workers at large more and more about their activities with the same intimate attention to detail as Sir Harold himself exhibited at Glasgow.

Zinc Industry and Protection

SIR ROBERT HORNE, presiding at the annual meeting of the Imperial Smelting Corporation last week, criticised the insufficient measure of protection given by the Government to the zinc industry and referred at length to the negotiations which had been conducted having for their object an increase in protection on the ground of higher wages and greater expense of fuel and transport charges in this country. In the result the producers were freed from the Ottawa stipulations, but the duty on foreign metal was reduced from 10 per cent.—which today would be equal to approximately 35s. a ton—to 12s. 6d. a ton. The Import Duties Advisory Committee, however, in recommending this procedure, recognised that the new rate of duty was "low," and that in the absence of agreement with overseas producers to control production and sales it might prove inadequate to safeguard the home industry. Sir Robert Horne gave an assurance that, while the directors were themselves of the opinion that a higher tariff—comparable with that of other industries whose products the corporation was compelled to purchase at increased prices—was the best ultimate solution, they would loyally co-operate in seeking an acceptable international agreement. Preliminary negotiations have already begun with a view to the creation of an international cartel, though he was unable to make any definite statement regarding the prospects of success. The interests of the Imperial Smelting Corporation now cover not only metal, but alloys, acid, fertilisers, pigments, and so on, and is to-day giving direct employment to over 3,000 workers.

Sir Ernest Benn's Tenth Book

"MODERN GOVERNMENT," to be published quite shortly by George Allen and Unwin, Limited, is Sir Ernest Benn's tenth book and comes three years after his last "This Soft Age." In the interval this indefatigable advocate of Individualism has produced 75 numbers of the ill-fated "Independent." "Modern Government" breaks new ground, for it is in no sense a party book. The tone is, of course, anti-socialistic, as must be expected from the author of "The Confessions of a Capitalist," but Sir Ernest has managed to avoid any mention of Socialism, or for that matter, any other sort of *ism*. He has made an attempt to study government as a subject. The argument is that we are so busy with all the details of governing ourselves that we have neglected to consider the principles underlying all good government. "Modern Government" may be described as a restatement of the case for man versus the State, supported by arguments and illustrations from post-war experience. Sir Ernest Benn's return to the arena will be welcomed by a world-wide circle of admirers. The book, which should be in the hands of the booksellers in the course of a few weeks, will enliven the discussion of public affairs, if only because of its ruthless attack upon the bureaucracy.

Aluminium Cooking Vessels

THERE has been widespread discussion, in the correspondence columns of the Press and elsewhere, since Dr. G. W. Monier Williams, who is in charge of the chemical laboratory of the Ministry of Health, issued his report on aluminium in food, on the safety of aluminium cooking vessels from the point of view of health, showing that a great deal of anxiety still exists. Professor H. E. Armstrong, who confesses that he has had only seventy years' experience of chemistry, has entered the controversy this week with a letter to the "Times" in which he strives to allay the fears expressed by other writers. Although the weight of chemical evidence appears to be almost entirely on the side of safety, it seems to us that more extensive inquiry is desirable. Medical and analytical considerations should be brought under review, but ultimately the problem is essentially a chemical one, and two at least of the subject groups of the Society of Chemical Industry—the Chemical Engineering Group, dealing with the properties of the metal, and the Food Group concerned with the problem of food purity—might get together to find evidence likely to be of value in reaching a verdict.

Inquiry should be directed to the discovery of objective signs of injury. Experiments to that end can undoubtedly be devised and might, if properly controlled, afford information of the greatest importance. It is clearly in the public interest that doubt should be set at rest with as little delay as possible.

British Association of Chemists

Eighteenth Annual Meeting and Dinner

THE Poisons Board Regulations and unemployment formed the main themes at the eighteenth annual meeting of the British Association of Chemists at the Adelphi Hotel, Liverpool, on November 30, when Professor E. C. C. Baly was re-elected president for a fourth year of service.

Mr. W. H. WOODCOCK, hon. treasurer, in presenting his report, said that for the first time for many years they had a deficit—£191. Their balance had been accumulating for some years so as to be ready for any emergency. Such an emergency had arisen during the past year and they had not hesitated to use that money.

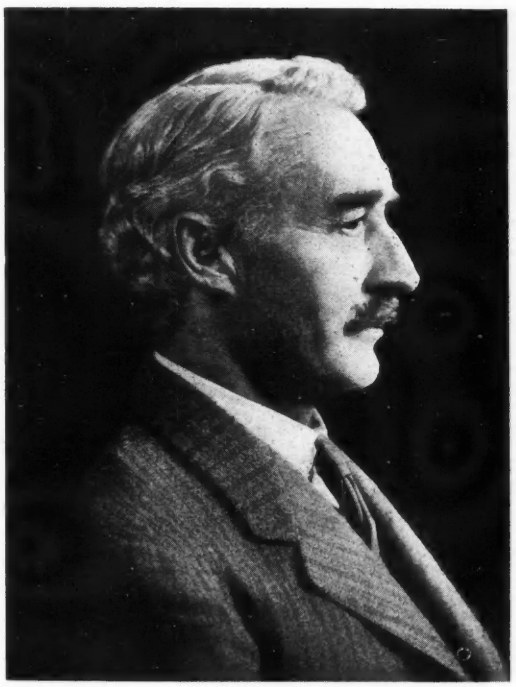
After a short discussion on the question of investments, during which Mr. Hirst (Wigan) observed that it cost £580 to pay out £500 in unemployment benefit—or £11 for every £10 paid out—the report was adopted and the treasurer thanked for his services.

Mr. WOODCOCK said that besides the actual payment of £500 they had to pay the cost of cheques and postages and there was considerable expense in checking and verifying their claims.

Mr. C. S. GARLAND, presenting the report of the Council, said that the total membership was now 1,785. During the year 138 new members had been elected. In the early part of the year the result of the depression in industry was still apparent, but the number of applications for membership increased substantially in the latter months. One consequence of the depression had been a diversion of trained chemists from the chemical profession to other branches of industry, and this accounted for 55 resignations. It was with regret that they recorded the decease of six members, including Dr. H. M. Atkinson, who vigorously supported their work. Under the rules, ten names had been removed from the register. There was a net increase of 67 members. At the council meeting that day they had the largest number of new members elected in the history of the Association. By the early payment of subscriptions, members had helped the treasurer and council to take the most energetic steps to protect their interests. Certain measures required that prompt action had to be taken with the least possible delay, and this involved considerable expenditure. Under the prevailing industrial conditions there was an inevitable fall in donations, and when members could conveniently do so, it was hoped that they would continue to respond as generously as they had done in the past. The legal aid fund again recorded a number of successes, and members who had benefited had made corresponding financial recognition. Excellent work had again been done by the special aid fund and several urgent cases had benefited by prompt assistance. Whilst strict economy had been exercised, the accounts showed very clearly the great expansion of their work.

During the past year the calls on the unemployment benefit fund had fallen considerably. Although claims had been numerous they had been for smaller amounts and for shorter periods. The total disbursements at £500 for the twelve months were substantially less than those for the previous three years. This clearly indicated the great improvement in industry, and in the employment of chemists.

The number and value of appointments notified to members tended to increase, and they could again record with satisfaction that an increasing number of employers approached the Association when they had high-class vacancies for chemists. That status and experience commanded adequate remuneration was being more widely appreciated. A much larger number of chemists now knew that the employer expected to pay an adequate scale of remuneration for high qualifications and experience.



Professor E. C. C. Baly, F.R.S., who has entered his fourth year as President of the British Association of Chemists.

The steps taken by the Association in regard to the report and recommendations of the Poisons Board were of great importance not only to members of the Association but to the profession generally. It was essential to stress the point that the British Association of Chemists had, in all it did, borne in mind the larger issues involved. The ultimate question had not been, and was not, whether this chemical body or that should be included in the Poisons Schedule, but to what extent the profession was adequately represented in the regulations which it was proposed should be laid down. It was not denied that in the case of the profession of chemistry there existed no society or other body representative of the whole profession; so that it was unprecedented and contrary to public and professional interests to lay down that a particular society should be deemed to represent—for the purpose of manufacture of medicinal preparations containing poisons—the whole profession of chemistry.

On a last analysis it was upon these grounds that the Council regarded the action it had taken as imperatively necessary. It was decided (1) to publish a special article in the Association's Journal drawing attention to the unsatisfactory nature of the Poisons Board report as it was related to the suggested qualifications for the control of the manufacture of medicines containing poisons, (2) to publish letters and articles in the technical Press to direct public attention to the gross inaccuracies in the report, (3) to obtain the co-operation of all members in addressing protests to individual Members of Parliament, (4) to address a letter to the Home Office drawing the attention of the Home Secretary to the report of the Poisons Board and requesting him to receive a deputation. A letter written by Professor Baly, published in the "Times" on July 6, drew a reply from the chairman of the Board, indicating that considerable importance was attached to the Association's representations.

Owing to the fact that it was impossible to complete the last stages of this programme earlier than ten days before Parliament rose, the full effect of the action taken was not yet known. It was evident, however, that the representations made had had considerable effect upon the departments con-

cerned and upon Members of Parliament. The council understood that the matter of the reception of a deputation by the Home Secretary was under consideration. More important than this, however, was the assurance received by a prominent official that the representations of the Association would be fully considered by the Home Secretary in his consideration of the report of the Board. It was unfortunate that the rapid decision to dissolve Parliament left the matter of the deputation in some doubt. It seemed improbable that the Home Secretary of the present Government would be in a position to receive the Association's representatives, and the matter might have to be reopened with the Home Secretary under the new Government.

Developments Closely Watched

Despite these obstacles it was certain that the rules would not be ratified in their present form. Developments were being closely watched by the council so that the interests not only of its members, but of the whole chemical profession might be protected. Mr. Garland remarked that quite briefly their point was that whilst the Institute of Chemistry did not represent the whole of the profession, they had equitable rights to representation. They had been assured that the matter would be amended before it was brought before Parliament again.

The Ministry of Labour had continued to notify the Association in all cases where application was made for a permit to employ a foreign chemist, the result being that several valuable appointments had been notified to British chemists with the requisite experience during the past year.

Members continued to consult the legal aid department in connection with their agreements. During the past year advice had been given on a larger number than in any previous year. The total sum of members' salaries recovered, without recourse to the courts, was £762 10s. Although this total was a modest one it represented a considerable number of cases, which had been dealt with by their solicitors by negotiation. For the first time on record the legal aid fund had been able to meet the charges during the year without recourse to the general fund.

The Unemployment Special Purposes Committee reported that although numerous calls had been made on the fund, the total payments of benefit had decreased, largely through the activity of the appointments bureau. It had, therefore, only been necessary for the majority of members to claim benefit for short periods. The committee recommended again that the additional payment of 2s. 6d. per unit after five years' subscribing membership be continued. It had also had under consideration the possibility of including a scheme of sickness insurance in the activities of the Association. No decision had, however, been made as the matter was still being debated. Of the suggestions referred to sections from the annual general meeting last year the ballot showed that members were decidedly in favour of extending the benefit for a further period. Confirmation of this at their next annual meeting would enable the committee to take expert financial opinion.

Dr. F. W. KAY, proposing the adoption of the report, paid a tribute to the work of the general secretary, Mr. C. B. Woodley. Mr. G. C. RILEY seconded.

Professor Baly's Re-Election

Mr. C. S. GARLAND proposed the re-election of Professor E. C. C. Baly as president, and Mr. H. T. F. RHODES seconded.

Professor BALY, in returning thanks, said he felt the Association had a great future before it. He hoped that the work at present in hand would raise the status of their profession. Other officers were elected as follows: Vice-presidents: Wm. E. Kay, J. Bristowe P. Harrison; Professor I. M. Heilbron; Professor A. G. Green; Sir James C. Irvine and Dr. Paul Haas; hon. registrar, Professor E. C. C. Baly; hon. treasurer, W. H. Woodcock; hon. editor, H. T. F. Rhodes; auditors, Messrs. Hughes and Allen. The following members of council were elected by sections.—London: Miss W. Wright, G. T. Gurr and Capt. R. P. Porter; Liverpool: L. Wild and G. C. Riley; Birmingham, H. W. Rowell; Manchester, P. Chorley, A. Hill, and F. Page-Evans; Notts and Derby, J. C. Hibbert; Scottish, R. W. Dunlop.

Professor BALY moved a resolution supporting the action of the council in protesting against the inaccurate statements made in the report of the Poisons Board, *inter alia* (a) "We are faced with the fact that there is in this country no recognised body other than the Institute of Chemistry that issues certificates or other documentary evidence of competency in chemistry as such," and (b) "The Institute occupies in respect of the chemical profession much the same position in this regard as do the General Medical Council and the Council of the Pharmaceutical Society in respect of the medical and pharmaceutical professions." On behalf of its membership of fully-qualified chemists the Association demanded to be included in Section 27 of the report. The Association, while regretting that the Poisons Board did not find it possible to receive the accredited representatives of the Association prior to the publication of the report, welcomed the expressed intention of the Home Secretary to receive the representatives of the Association before the rules are amended.

The Institute's Claim

Referring to what had already happened in regard to their opposition to the statements, Professor Baly referred to a letter in the "Times" in which he had severely criticised the report. The letter elicited a reply from the chairman of the Board—a remarkable tribute to the standing of their Association. It would be remembered that the Institute of Chemistry laid claim to special distinction by reason of its Royal Charter. In consequence of its claim to the sole right of passing candidates in chemistry and issuing certificates, he wrote to the secretary of the Privy Council asking whether the Charter conferred on the Institute the sole right of certifying competency in the profession. The reply was that there was nothing in the Charter which conferred the sole right on the Institute, and the letter went on to say that any other association could get a Charter of the same kind. In other words, it supported their contention that the Institute's claim was untrue. One of their greatest difficulties was that they were not consulted by the Poisons Board before the regulations were drawn up, so that the British Association of Chemists was not included in the societies allowed to be included in the bodies represented in the regulations.

Mr. C. S. GARLAND seconded the resolution.

Mr. Rhodes on Poison History

Mr. H. T. F. RHODES, speaking on the control of the sale of poisons, said that had control existed in the 15th century poisoning, which became a fine art, would not have been so largely practised. Had the sale of arsenic been controlled Alexander VIth and his son Cæsar Borgia might not have obtained the control in Italy that they did, and the whole course of European history might have been changed. They were expert poisoners and they used arsenic scientifically. He often wondered how many people died in England yearly, apparently from natural causes, who had in fact been poisoned by the expert administration of arsenic. In the case of some poisons we had hardly advanced in legislation for their control beyond the standards of the 15th century. But the advance of chemistry and biochemistry made legislation more necessary than ever. Certain substances not formerly classed as poisons could be very dangerous agents in the hands of those who wished to murder without leaving a trace of their crime.

Insulin was an example. It was a substance which consisted of two hormones and it was used to treat diabetes. The effect of these hormones was on the one hand to oxidise

the sugar in the blood and on the other to increase the storage of glycogen. An overdose was thus extremely dangerous since it reacted upon the muscular system, particularly that of the heart, causing heart failure. The most interesting point was, however, that the insulin was decomposed, and could not be traced in the body after death.

There were other substances which could be used, not with intent to murder but for other unscrupulous motives. An example was scopolamine, sometimes wrongly called the "truth serum." It was not a serum but an alkaloid, and when administered in a certain way it was said to have a certain psychological effect which caused men to speak the truth whether they wished to or not. Experiments had been tried with this drug on criminals in America. What the effect really was was uncertain, but there was little doubt that it was profound and that it took men off their guard so that they would make admissions that they would withhold when in a normal state. It was perfectly obvious what opportunities the existence of drugs of this kind gave to the unscruplous.

Danger of Injustice

The sale of such things was, of course, controlled, and now the Government proposed to control their manufacture in connection with medicines. That was all to the good, and the Association was in full agreement with such legislation. But it strongly dissented from certain clauses in the report of the Poisons Board. Those relating to the qualifications to be required of those who were to supervise the manufacture of poisons did not ensure that all those best qualified to undertake this responsible work would be able to do so under the proposed regulations.

If the report were not modified, great injustice would be done to the profession of chemistry as a whole, and proper control of the manufacture of poisons would not be achieved. They had made the assertion, which had not been denied, that the Institute represented only 40 per cent. of chemists. The Association wished to be included, because that would be a step in the direction of an organisation representing the whole profession, as did the General Medical Council that of medicine and the Pharmaceutical Society that of pharmacy.

Why did they want to be included? Because they were the British Association of Chemists and represented a large body of qualified chemists. Because, too, they wanted to see an association built up that was representative of the whole profession and they would not allow any society which did not represent the whole of the profession to speak on its behalf. The reason for their opposition was that no single chemical body represented the profession in the same way as the pharmaceutical and medical professions were represented.

Another speaker remarked that it appeared that any substance at any time could be put on the list by an Order in Council and that therefore quite a lot of them could be put out of work without being in a position to protest.

The resolution was carried unanimously.

Unemployment Insurance

Mr. C. S. GARLAND proposed a resolution welcoming the proposal to extend unemployment insurance to those earning more than £250 per annum, and expressing the view that, as there could be no logical reason for fixing any particular limit of salary, which would moreover perpetuate undesirable class distinction, unemployment insurance should be extended to cover all employed persons without reference to their earnings. Having regard to the proved low incidence of unemployment amongst chemists the resolution stated that the Association considered that the profession should have liberty within the Act to continue and extend its well-established scheme of unemployment insurance.

The resolution was seconded by Mr. Hirst (Wigan) and carried unanimously.

Professor BALY, in a short address at the conclusion of the meeting, referred to the recent discoveries of Spahlinger and remarked that his researches were of immense benefit to mankind in that they had proved effective against bovine tuberculosis. A recent report on large-scale experiments in Northern Ireland had been so satisfactory that the Northern Ireland Government proposed to bring in a Bill making it compulsory to inoculate every new-born cow.

The Annual Dinner

In the evening members of the Association and friends to the number of about eighty attended the annual dinner at the Adelphi Hotel.

Alderman EDWIN THOMPSON, J.P., proposed the toast of "The British Association of Chemists," coupling with it the name of Professor Baly. In a witty speech he remarked that he was inclined to think that the initials B.A.C. stood for "Baly and Co." He made a plea for the chemist to advertise his achievements more than he did. They had many instances in their own city. There was the research in connection with the silting up of the Mersey and in connection with the Mersey Tunnel. He wished someone would write the history of that wonderful achievement from a chemical standpoint.

Professor BALY, in responding, related the achievements of the British Association of Chemists and remarked that he was grateful for the honour they had done him in electing him for a fourth term of office as president.

Professor W. H. ROBERTS, Liverpool City Analyst, proposed the toast of "The Profession of Chemistry," coupled with the name of Mr. W. A. S. Calder, and related briefly the history of the older societies. Formerly, he remarked, there were three classes of chemist—the academic, the consulting and the industrial—but it appeared to him that the days of the consulting chemist were almost past. He considered that if they could co-operate more they would be a much greater force for good in the country. He would like to see the word "chemist," too, used in its proper sense and not to describe also the pharmacist and the druggist, as people in this country were prone to do.

Mr. W. A. S. CALDER, president of the Society of Chemical Industry, in responding, said that their profession was one of which he was very proud and its ramifications over the industrial field wide and varied.

Mr. L. WILD, chairman of the Liverpool Section, proposed the toast of the guests, for whom Sir Reginald Craddock, M.P. for the Combined Universities, responded.

Zinc Industry

Conditions More Favourable for a New Cartel

ENDEAVOURS which are being made to form a new international zinc cartel were referred to by Sir Robert Horne at the annual meeting of the Imperial Smelting Corporation, Ltd. He stated that preliminary negotiations had already started, and that his company would co-operate with those in other countries in seeking an acceptable international agreement. It will be remembered that the old cartel, which embraced all important spelter producers outside the United States, broke down on December 31, 1934. The immediate causes of its collapse were, first, the unhealthy effects of the British 10 per cent. duty on non-Empire spelter, secondly, the increased German production, and finally the difficulties of producers situated in the gold bloc. Since the war a number of revolutionary developments for the separation and concentration of zinc ores have enormously increased the capacity of the industry. For this and other reasons, the capacity of the industry is to-day considerably in excess of consumption.

General view of the Exhibition arranged by Imperial Chemical Industries, Ltd., to show the industrial applications of the new blue pigment, Monastral Fast Blue BS.

Monastral Fast Blue BS

A Milestone in the History of the Dyestuff-Making Industry

THE introduction of Monastral Fast Blue BS by the Dyestuff Group of Imperial Chemical Industries, Ltd., is a milestone in the history of the dyestuffs industry. In spite of the advances made in all branches of the industry, there has not been, up to the advent of Monastral Fast Blue BS, a blue pigment which possessed all-round fastness properties coupled with brilliance of shade.

Since the discovery of the first coal-tar dyestuff in 1856 no stone has been left unturned in efforts to provide new and improved products for the colour-consuming industries. In the inorganic field little or no outstanding progress has been made as regards the discovery of new blue pigments since the introduction of Prussian blue in 1704 and of synthetically-produced ultramarine in 1826. Enormous developments have, however, taken place in the organic field, particularly in the production of the insoluble pigment dyestuffs. In this class we have a range of yellows, oranges, reds, scarlets, maroons, violets, greens and blacks, possessing properties which generally meet the demands of the pigment-consuming industries.

The pigment-consuming industries cover the manufacture of oil paints and enamels, cellulose lacquers, synthetic resin finishes, printing inks, coated papers, wallpapers, linoleums, artists' colours, distempers, water paints, leather and leather-cloth, rubber, and moulding powders, each requiring colours possessing properties which are peculiar to the individual industry concerned. The requirements of these industries are, to a large extent, adequately met by either natural, inorganic or organic colouring matters in all shades except blues, and the production of suitable blue pigment colouring matters has always been a major problem. In considering the available blue pigment colouring matters, however, it is found that they all possess inherent faults which render them unsuitable for one purpose or another. Ultramarine is destroyed by acids, even in a dilute form, whilst Prussian blue is destroyed by alkalies. In the organic field, the blue lakes from the coal-tar dyestuffs and certain water-insoluble blue dyestuffs, whilst meeting the requirements of some industries, are entirely unsuitable for others. It will, therefore, be realised that the quest for a universal blue pigment dyestuff is one at the end of which is a prize worthy of the seeking.

Monastral Fast Blue BS, the new product of Imperial Chemical Industries, Ltd., is an insoluble pigment dyestuff possessing a most beautiful shade of blue. From a reddish blue in strong shades it merges through varying shades of blue to a brilliant greenish blue in pale (pastel) shades. It possesses amazing properties in that it appears to combine in itself all the most desirable properties of the ideal blue pigment dyestuff, and is thus suitable for practically all pigment dyestuff-consuming industries. Its fastness to light is excellent, whilst it is absolutely fast to acids, alkalies and lime. It is completely insoluble in oil, spirit and nitro-cellulose solvents. It will withstand temperatures up to 390° F., rendering it particularly suitable for tin-plate printing and

stoving enamels. As a pigment it will therefore be of particular interest to manufacturers of oil paints and enamels and cellulose lacquers, enamels, printing inks, distempers and water paints, moulding powders, soaps, sealing waxes, artists' colours, wallpapers and coated papers, leathercloth, bookcloth, linoleums and all products where general all-round fastness and brilliance of shade are of major importance.

Owing to its all-round general fastness, texture and working properties, this new blue is the nearest to the ideal blue pigment dyestuff yet produced. It is to be marketed in both paste and powder forms, and while the uses to which it can be put have not been fully explored, it can definitely be stated that there is no other blue pigment which possesses such unique fastness, combined with extreme brilliance of shade, purity of tone and high tinctorial value.

Trichromatic Blue for Printing Inks

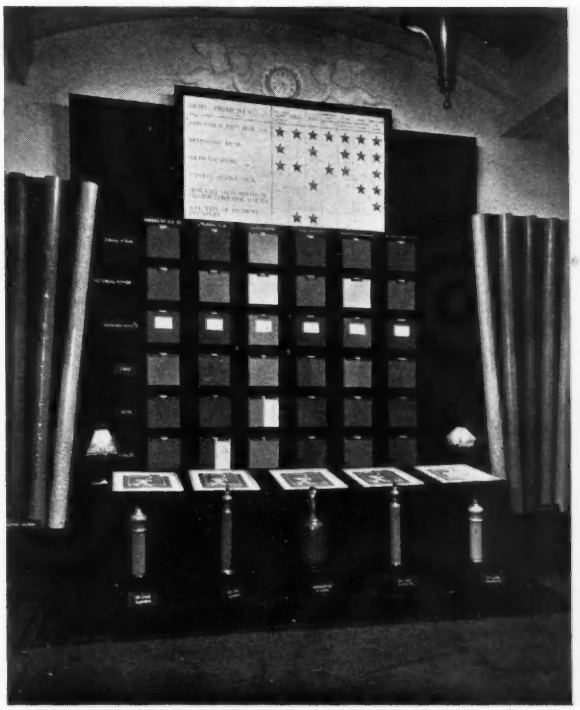
Taking its various potential industrial applications, the new pigment should be of particular importance to the printing ink industry, and spectrophotometric analysis shows that it is the nearest approach to the ideal trichromatic blue yet produced. In three-colour printing it supplies the need for a true "minus red" pigment. With a broader reflection band extending on both sides of the blue-green portion of the spectrum than the standard blue-green ink of the Federation of Master Printers, it will thus not only give, by admixture, better greens and better purples, but should greatly increase the range of three-colour work generally. Moreover, its all-round fastness, good working properties, ease of wetting, and brilliance, make it particularly suitable for such exacting printing operations as the printing of soap wrappers; while its heat resistance enables it to stand up to the number and severity of the baking operations required in modern multi-colour tin-plate lithography.

Paints, Varnishes and Enamels

Such functions of the pigment itself as texture, ease of wetting, oil absorption, floating, shade and strength all conform exceptionally well to established requirements when Monastral Fast Blue BS is used in the manufacture of paints and lacquers. Used in combination with the Monolite Fast Yellows or the lead chromate pigments, it gives non-floating greens which are brighter, stronger and less liable to cause livering than the normal Brunswick greens—a point which should be of special interest to manufacturers of nitro-cellulose lacquers and synthetic resin finishes, in which the effect of the media on the floating of greens is an important problem. Monastral Fast Blue, having no harmful effect on the lacquer, either in bulk or as a film, and giving a rich, reddish blue in mass-tone and a brilliant greenish blue on reduction, should come as a boon to the nitro-cellulose lacquer industry, in which the fast-to-light blue pigments hitherto available have been practically limited to Prussian blue, with its attendant grinding difficulties.

In the field of synthetic resin finishes the new pigment, in conjunction with drying-oil or thermo-hardening glyptals, offers a paint system where the pigment (unlike such colours as ultramarine) does not adversely affect the exceptional durability of the vehicle, and which possesses outstanding resistance to light and heat. Being also chemically inert, and having no harmful physical effect on the film, it may be used in oil paints without any risk of livering, chalking and loss of gloss. In addition to requiring half the grinding time of Prussian blue, it is more light-fast, and has more than twice the tinctorial power of that pigment. It is brighter in reduced shades than either Prussian blue or ultramarine, whilst its oil absorption is of the same order as Prussian blue.

Monastral Fast Blue should also supply the definite need for a brilliant blue pigment suitable for use in distempers. Being fast to the alkaline reaction of lime, it is unaffected even when applied to freshly plastered walls, and it should



Monastral Fast Blue BS: A Section of the Exhibition demonstrating the seven important features of the new blue pigment in comparison with other blue pigments.

be of great value for the production of the different hues of blue and green needed in distempers. The same qualities point to its value in the wallpaper and paper-coating trades, in which it should help to meet the present demand for bright and delicate pastel shades in wallpapers.

For the paper trade, the new pigment compares very favourably, both in fastness and tinctorial power, with the vat dyestuffs commonly used in pigment form, and paper dyed with it is fast to light, acid and alkali, and is free from changes in shade when viewed in artificial light. Being marketed in the form of a highly dispersed paste, the full depth of shade is very rapidly developed on addition to paper stock in the beater, and the addition of the usual sizing agents only is required to fix the colour firmly upon the fibres, and to produce paper free from two-sidedness.

Leather Cloth Manufacture

Monastral Fast Blue should also advantageously replace the natural and inorganic pigments and lakes used for colouring the nitro-cellulose dope in the manufacture of leathercloth. Being also fast to light in a greatly reduced shade, it is also particularly suitable for the production of fast to light pastel shades for bookcloth, in which it will be unaffected by washing or sponging with alkaline cleansers. For the colouring of linoleum, it can be relied upon to withstand high mixing temperatures, to be unaffected during the maturing process, and to be fast to repeated washings and scourings with alkaline agents. It also opens up new possibilities in the colouring of concrete, cement tiling, mixed cement stucco, and modern wood cement flooring compositions. As a rubber pigment, it gives excellent shades in all rubber processes, and under all conditions of vulcanisation. It is also ideal for use in plastic compositions, since it is capable of resisting, without change, the highest moulding temperatures as well as the effect of formaldehyde and of different catalysts. Finally, in textile printing, it offers a means of securing all the effects to be obtained from mineral pigments without having to guard against their known failings.

The Handling and Storing of Acids

Some Limitations of Modern Constructional Materials

AT a meeting of the Chemical Engineering Group on November 15, Mr. T. J. Dixon and Mr. F. Roffey, of Imperial Chemical Industries, Ltd., read a joint paper on the handling and storing of acids, Mr. Stanley Robson, chairman of the Group, presiding.

The acids discussed in the paper were those commonly handled in the heavy chemical industry, *viz.*, sulphuric, hydrochloric, nitric, acetic, formic and oxalic acids, and it was pointed out that none of them are handled in such quantities or against such pressures as to present any difficulty as a problem in hydraulics. The difficulties which do arise, as is often the case in chemical engineering, are due almost entirely to the problems presented by corrosion. The paper therefore consisted very largely of a consideration of the materials of construction which are resistant to corrosion and a description of certain items of equipment, the design and fabrication of which are dictated by the constructional limitations of materials capable of resisting corrosion.

Synthetic Resin Compounds

In considering materials of construction for equipment used in handling acids, the authors pointed out the wide range of metals and non-metals which are employed: Cast iron, mild steel, alloy steels, aluminium, lead, silver, copper, bronzes of various compositions, glass, stoneware, vitreous enamels, rubber, and synthetic resin compounds. In the case of sulphuric acid the commonly used materials are lead for acid below about 77 per cent. strength, and cast iron and steel for higher strengths. In handling hydrochloric acid, non-metals must be used in contact with the acid, and although until recently the only materials used on a large scale have been stone, earthenware and glass, with a small use of rubber and ebonite, developments have taken place towards a very much greater use of rubber and ebonite and in a new type of material based on the compounding of synthetic resins. These materials are applicable to both 27 per cent. and 35 per cent. acid, which are the strengths usually handled. The handicap imposed by the restriction to non-metals is mostly noticeable in pumps.

Co-operation Between Plant-Makers

Storage vessels for hydrochloric acid are now almost universally constructed of steel and lined with rubber or ebonite, but whilst considerable advance has been made in the technique of rubber covering as applied to steel, finality has by no means been reached with regard to the most suitable quality of rubber. The successful construction of a vessel lined with rubber or ebonite depends to a great extent on co-operation between the firms fabricating the steel shell and the rubber firm, in order that the former may fully understand the requirements of the latter. Matters of importance in this connection include the quality of the welding of seams and mountings, in as much as a porous weld can cause endless trouble in the lining process and may even prevent a lining being applied successfully, owing to the air occluded in the pores of the weld expanding during the curing process and causing blisters in the lining, thereby preventing proper adhesion. The same kind of trouble can be traced to irregularities on the surface of metals such as rivet heads. Another important point was the method of fabricating flanges, particularly the large end flanges of circular vessels; the ideal method was to spin the circumferential plates themselves to form the flange.

At one time stoneware and brick were almost exclusively used for handling nitric acid, but the change-over now taking place to the almost exclusive use of metals for this purpose has been made possible by the development of austenitic steels and the improvements which have taken place in the technique of aluminium fabrication. Austenitic steels are used with complete success with acid up to 80 per cent strength, whilst above that strength aluminium is best used. The all-important point is that the aluminium must be of not less than 99.5 per cent purity and any welding employed must be first class.

Aluminium of 99.5 per cent purity is now used with complete success for handling acetic acid of strengths above 90 per cent in the cold, and ebonite covered steel for acid below 90 per cent strength. Pure formic acid is extremely corrosive and very few materials are completely unattacked by it either hot or cold. The metal in common use is lead, which is remarkably satisfactory for both hot and cold acid owing to the fortunate circumstance that the product made in the ordinary way from sodium formate and concentrated vitriol contains a small quantity of sodium sulphate dust which reacts with lead formate formed by corrosion of the lead sulphate on the metal. It has also been found that chemical lead and the physically-stronger tellurium lead are equally satisfactory after pickling.

Oxalic, the only solid acid on the list of acids dealt with, presents few difficulties in handling and transport so long as it is kept dry. Most oxalic acid crystals and solutions in water are corrosive and necessitate the use of special materials, the commonest being lead or steel covered with hard rubber, although the former is now being largely replaced by the latter because of the high percentage of purity required in the finished product.

Points from the Discussion

Several speakers referred to the difficulties arising from the use of hot acids as far as their effects upon materials of construction are concerned, and attention was also called to the manner in which steel tank wagons handling sulphuric acid of 70 per cent. strength have stood up when the acid has been cold. The authors' views after experience with tellurium lead was asked for also by a number of speakers. Difficulties with rubber and ebonite linings also received considerable attention, and there was general agreement that there should be more co-operation between the rubber manufacturer and the maker of steel vessels for the handling and storing of acids. The authors had mentioned that there was no satisfactory mechanical pump for handling hydrochloric acid, but Mr. E. A. Reavell pointed out that a pump made of "Keybush" is working very satisfactorily.

Mr. W. E. SPEIRS spoke in favour of a greater use of stoneware which he said is resistant to all acids of all concentrations.

Mr. G. A. SMY referred to having been concerned with the transport of thousands of tons of 70 per cent. sulphuric acid in steel vessels, with as much as 100 tons in a single vessel, and he said he had used soft rubber, hard rubber and ebonite for linings of vessels for hydrochloric acid with complete success.

The influence of impurities in acids and their effect upon handling and storage vessels was mentioned by another speaker, and Dr. A. J. V. UNDERWOOD referred to the use of centrifugal pumps of the glandless type, made of high silicon iron, for acetic acid cold. The use of austenitic iron as distinct from austenitic steel was mentioned by another speaker who asked for information.

The AUTHORS, in their reply, said there should not be considerable difficulty in the handling of sulphuric acid from the point of view of temperature, if the coolers were kept close to where the heat was being applied and the acid was passed through the collers before pumping. As to tellurium lead, one tank had been in use for 2½ years and still seemed in perfectly good condition; it was not yet possible to speak of its qualities in resisting chemical attack. The authors also said they had had no experience of austenitic iron.

Industrial Spectrum Analysis in Action

By C. J. D. GAIR, O.B.E., F.C.S.

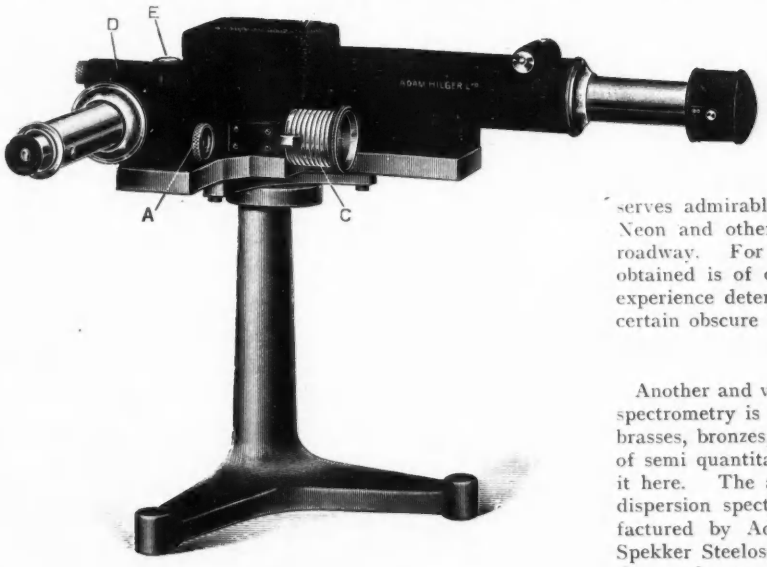
THERE appeared recently in THE CHEMICAL AGE (July 20, 1935, *et seq.*) a series of three articles on Industrial Spectrum Analysis by Dr. C. S. Hitchen and the author. In these it was sought to show the main lines upon which such work was conducted with instruments of modern design. With the space available at the time it was obviously impossible to do more than introduce very briefly so considerable a subject, and the reader was advised to study the current literature for himself if sufficient interest had been aroused. This present article does not attempt to amplify the information given in regard to methods as such, but considers spectrum analysis actually at work controlling the quality of materials and guaranteeing their conformity to certain specified standards. The former articles are thus rounded off, and in some small way the industrial value of this most recent analytical process revealed.

Mr. C. J. D. Gair.

It will be realised at the outset, however, that only a brief outline of the facts can be attempted, for it would require a book of considerable dimensions to deal with the subject in its entirety. It is hoped, however, that an incentive may be furnished for further study and experiment. The subject divides itself naturally into three main divisions, *viz.*, qualitative, semi-quantitative, and quantitative, and it is proposed to deal with it under these headings as far as possible.

Qualitative Visual Work

The apparatus required is of a very simple character and consists principally of a spectrometer. In buying such an instrument it is well to bear in mind the desiderata of combined accuracy of wavelength measurements and convenience. For such there is nothing to equal the "constant deviation" type, as illustrated. In addition to a spectrometer an arc stand and condensing lens will frequently be required; details of these will be found in the articles already mentioned. It is true that for certain qualitative work, such as that employing flame spectra, neither arc stand nor condenser will be required, but as these pieces of apparatus are inexpensive and are always likely to be wanted it is advisable to procure them at the outset. In passing it may be noted that qualitative work, as a whole, may be divided into methods employing the eye and those employing the photographic plate. The latter are usually concerned with the ultra-violet regions of the spectrum and will be considered later. Visual work is concerned with the rapid detection of traces of metallic impurities in powders, residues and precipitates both organic and inorganic.



The method usually employed consists in the production of arc spectra and their examination for distinctive lines and groups of lines. For this purpose purified and cored carbon electrodes are employed, the lower electrode containing a small quantity of the sample under examination. A very good description of the procedure, largely used by Sir H. Jackson, F.R.S., is given in D. M. Smith's book "Visual Lines for Spectrum Analysis." This book also furnishes wavelengths of many sensitive lines suitable for the purpose in view. The actual time taken for the detection of an impurity by such observation is a matter of minutes only. Many instances could be given of the method in action but two only must suffice. The presence or absence of copper, zinc and other metallic elements in substances such as bottled peas and other vegetables is settled very speedily by visual spectrum analysis. It has also been recorded by D. M. Smith that mercury can be identified with certainty in a flash of lines which does not last for more than 1/5th second. He goes on to say that it would be practically impossible in such a short time to identify this element by a photographic process.

It is not necessary to do more than mention in passing the value of ordinary flame spectra observations. These have been systematically utilised for certain works purposes since the time of Bunsen and Kirchoff.

There is another way of employing the spectrometer, and this is of comparatively recent date. At times it is necessary to observe the nature and behaviour of electrical discharge lamps now so much in evidence as advertisements, signals, etc. For this purpose a direct vision spectroscope with or without illuminated scale serves admirably, and by it Incandescent Mercury Vapour, Neon and other lamps may be examined in situ from the roadway. For certain investigations the information so obtained is of considerable value, and in the author's own experience determinations of this character have cleared up certain obscure questions in connection with public lighting.

Use of the Steeloscope

Another and very important industrial application of visual spectrometry is in connection with the sorting of steel rods, brasses, bronzes, etc., and though this partakes of the nature of semi quantitative work it will be convenient to deal with it here. The apparatus required is a special type of high dispersion spectroscope, a suitable form of which is manufactured by Adam Hilger, Ltd. under the name of the Spekker Steeloscope. There are two forms—the ferrous and the non-ferrous; the former is used for steel samples only and the latter for brasses, bronzes, etc. The Steeloscope enables a very rapid semi quantitative estimation of Ni, Cr, Mn, Mo, Ti, W, Co, Cu, Sn, Cd and V to be made, and the non-ferrous instrument Sn, Pb, Fe and Mn. At one of the largest British steelworks the former kind of instrument has been installed for some years, and the author was recently privileged to see the same in action. It was indeed remarkable

to observe the facility with which an ordinary workman was able to differentiate between a carbon steel containing less than 0.5 per cent. nickel and one containing 1 per cent., case hardened nickel steels containing 2, 3 or 5 per cent. nickel, a 3 per cent. nickel steel from a 3 per cent. nickel chrome steel, and so on. The steeloscope was also used to determine the quality of scrap selected at random from various works bins. In about half a minute an observation was made, the time taken being almost entirely employed in moving the bars into position and switching on the current.

Qualitative Methods Utilising the Ultra-Violet

Regarding qualitative methods utilising the ultra-violet, the essential apparatus is a quartz spectrograph with arc and spark stand and quartz condensing lens. An instrument of medium dispersion is preferable for general purposes. As an illustration of the use of such the following may be cited. It is necessary at times to incorporate beryllia in small quantity, say, up to 0.5 per cent. in certain highly refractory substances. The presence or absence of this oxide in such mixtures is of great moment, but its detection by chemical means one of no small difficulty. Fortunately, however, the spectrograph reveals the presence of this oxide with considerable ease if the technique employed is correct. It is necessary in the first place to fit in front of the spectrograph slit a simple piece of apparatus called a Hartmann diaphragm; this consists of a plate of metal with three small rectangular holes so cut that by movement across the slit three spectrograms can be taken in juxtaposition. Pure copper electrodes are used and the first spectrogram taken is of these only, the second of the sample under examination plus the electrodes, and the third of a drop of dilute beryllium nitrate solution placed on the lower electrode. It was found in practice, however, that owing to the evanescent character of the beryllium emission it was difficult to guarantee photographing the lines. To overcome this the shutter of the spectrograph was opened *before* the current was switched on, and this simple expedient ensured the detection of the beryllium doublet $\lambda\lambda$ 3131.1 and 3130.4.

This instance from actual working practice indicates the kind of routine qualitative work the spectrograph can do, but F. Twyman, in his book "The Practice of Spectrum Analysis," makes it abundantly clear that semi quantitative results can also be obtained with the simple apparatus outlined. He says: "Using the spectrograph alone with its ordinary equipment, approximate estimations may be made which are often of great value where the quantities present are small . . . investigations have established that even in very unfavourable cases one can distinguish between 0.005 and 0.01 or between 0.1 and 0.2 per cent. of most metallic impurities by simple inspection of the intensity of the lines." He goes on to state that whereas the chemical detection of small quantities of Ni, V and Mo in a steel, or Zn, Pb, etc., in approximately pure copper, is a matter of difficulty and involves tedious chemical separations, there is no uncertainty or difficulty in such detection by spectroscopic analysis. We have unfortunately no time in which to consider the many examples of similar work given in "Clinical and Pathological Applications of Spectrum Analysis," by Gerlach and Gerlach, but the reader is strongly advised to consult this valuable work for himself.

Quantitative Analysis by Quartz Spectrography

Coming now to the full applications of the instrument for quantitative work proper it is perhaps advisable to epitomise in a few words what was said in the third article of the series already mentioned. It was shown there how a rotating logarithmic wedge sector is interposed between the arc or spark and the slit. Because of this sector the spectral lines are found to be pointed and of various lengths. Actually the difference in length of two closely neighbouring lines is proportional to the log of the ratio of their intensities. By line measurement the method can be used for determinations such as tin in tin-lead alloys, various impurities in steels, and a wide range of industrial products. As instances of the use of this method the reader's attention may be drawn to a paper by E. S. Dreblow and A. Harvey entitled "Control Through Spectroscopy" ("Ind. Eng. Chem.," July, 1933). Here it is stated that "the British Post Office Engineering Department has specified that the lead sheathing of aerial cable must contain between 0.8 and 1 per cent. antimony. Throughout this range the spectrograph furnishes a quicker and more convenient test than is possible by means of chemical analysis and because of this the department recommended the adoption of the spectrographic test ("British P.O. Eng. Dept. Research Report," 5651, 1931). The actual technique adopted is that of the internal standard, the photometric side of the method being that originated by Scheibe and Neuhäusser. This latter involves the use of a rotating logarithmic sector in addition to the quartz spectrograph employed for registering the spectrum." It is also mentioned by Dreblow and Harvey that the method may be used for the estimation of cadmium and tin in lead, and "since the exposure that gives the antimony line also yields the cadmium and tin lines the speed of analysis is obviously increased."

An Authoritative Opinion

Morris Slavin, in his paper "Analysis with Wedge Spectra" ("Engineering and Mining Journal," December, 1933), gives valuable working details for the estimation of Cd., Pb, Tl and Ge in zinc and in concentrated zinc sulphate solutions of relatively high purity. This paper should be read in its entirety, but it may be mentioned that the author states therein that the problem that led him to use the spectrograph was the determination of Co, Fe, Cu, Cd, Tl, Ge and Pb in strong zinc sulphate solutions and of Fe, Cu, Cd and Pb in metallic zinc. This was in connection with an experimental electrolytic zinc plant. For Cd, Tl, Ge and Pb, the method was an unqualified success. As to accuracy, he states that for the majority of estimations the error was within 10 per cent. Very large errors never occurred with the spectrograph, though they sometimes occurred with chemical methods. As to speed the spectrograph plus sector was found to be particularly fast as compared with older spectrographic methods, the time taken being only 8 to 10 minutes in all. His final conclusion is that "there is every reason to believe that a scheme of procedure could be devised which would embrace practically every type of sample likely to be met." Such a considered opinion from the former spectrographer of the United Verde Copper Company of America shows the increasing hold of such methods on industry.

Flame Spectra

Finally, it is necessary to mention a fairly recent application of flame spectra observation for industrial analysis. In this method, which is due to H. Lundegardh, use is made of the acetylene flame as a means of excitation. The ultra violet spectrum resulting therefrom is photographed direct, and a series of spectrograms obtained from the sample under examination and of artificially prepared samples of varying percentage composition. Line intensities are determined by microphotometer and quantitative results thus obtained. The method is used for the estimation of alkali metals, iron and other elements in soils. It is of particular value in agricultural investigations. Details will be found in Lundegardh's "Die Quantitative Spektralanalyse der Elemente."

In conclusion, the author wishes to thank Messrs. F. Twyman, E. S. Dreblow and F. Simeon, of Adam Hilger, Ltd., for valuable assistance in the preparation of this article.

UNITED STATES exports of chemicals during the first nine months of 1935 reached a total value of £20,255,000, compared with £18,333,000 for the corresponding period of last year, or an increase of more than 10 per cent. Imports of chemicals and allied products increased from £15,329,000 to £15,599,000.

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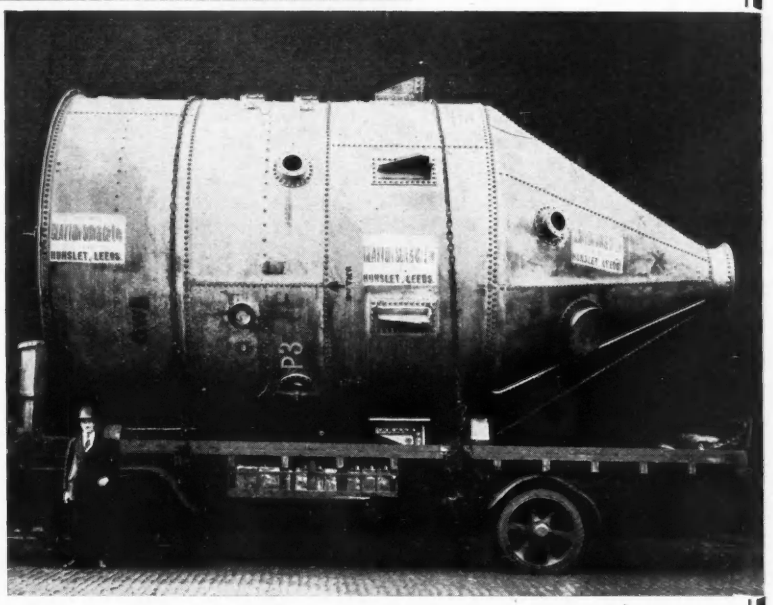

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Hydrogen Production by the Badische Process—III

Quantities for Design of Interchanger, Preheater and Scrubbers

In continuation of notes on the Economics of the Synthetic Manufacture of Ammonia, published in "The Chemical Age," October 5 to November 16 inclusive, the present series deal particularly with the design of the plant for the production of hydrogen by the Badische Process.

Heat required to raise steam from 102° C. to 480° C. = 72.6 × 0.47 × 378 = 12,900 C.H.U. per minute.

Heat required to raise 23.2 lb. water gas from 90° C. to 480° C. = 23.2 × 0.428 × 390 = 3,880 C.H.U. per minute.

Total heat to convey to gas = 16,780 C.H.U. per minute.

Temperature of exit gas from converter 550° C.

Heat available from exit gas in cooling from 550° C. to 170° C.

$$= (380 \times 0.47 \times \frac{949}{15}) + (380 \times 0.471 \times \frac{504}{15})$$

$$= 17{,}300 \text{ C.H.U. per minute.}$$

An exit temperature of 170° C. has been assumed, allowing a temperature gradient of about 90° C. throughout the interchanger. The steam will enter at a little over 100° C. and the water gas can enter at about 90° C., if it is considered to have previously been heated in a separate interchanger by steam, or by the gases leaving the interchanger.

Assuming a heat transmission of 4 C.H.U./sq. ft. per hour, *heating surface required*

$$= \frac{16{,}780 \times 60}{4 \times 90} = 2{,}780 \text{ sq. ft.}$$

Total area through interchanger tubes

$$= \frac{4{,}260}{1{,}800} = 2.36 \text{ sq. ft.}$$

This assumes a velocity of 30 ft. per second through the tubes, *i.e.*, 1,800 feet per minute. The volume passing is obtained as follows:—

$$H_2 = \frac{10{,}256{,}000}{1{,}440 \times 15} \times \frac{823}{293} = 1{,}330 \text{ or } 22.5\%$$

$$CO = \frac{393{,}000}{1{,}440} \times \frac{823}{293 \times 293} = 51 \text{ or } 0.9\%$$

$$CO_2 = \frac{5{,}160{,}000 \times 823}{1{,}440 \times 15 \times 293} = 674 \text{ or } 11.2\%$$

$$N_2 = \frac{590{,}000 \times 823}{1{,}440 \times 15 \times 293} = 77 \text{ or } 1.3\%$$

} 2,132 cu. ft.

$$H_2O = \frac{949 \times 823 \times 385}{293 \times 18 \times 15} = \frac{3860}{5922} \text{ cu. ft. per min. at 550° C. and normal pressure or } 64.2\%.$$

$$\text{or } \frac{5{,}922 \times 443}{823} = 3{,}190 \text{ cu. ft. at 170° C. normal pressure.}$$

or 4,260 cu. ft. at mean temperature and 15.7 lb. pressure.

Using 1½ in. diameter (10 S.W.G. thick), surface = 0.392 sq. ft./ft.

$$\textit{Number of tubes} = \frac{2.36 \times 144}{0.786 \times (1.3)\,2} = 258$$

$$\textit{Length of tubes} = \frac{2{,}780}{258 \times 0.392} = 29.5 \text{ ft.}$$

It would be more convenient to divide the interchanger into two portions of about 12 ft. length and 300 tubes. The dimensions of each would then be about 12 ft. × 4 ft.

Taking the pitch as 2.5 in. and the diameter of pipe 1.5 in., the percentage area of opening

$$= \frac{90.5\ (1.5)^2}{(2.5)^2} = 32.6\%$$

Therefore, total area = $300 \times 0.786 \times (1.3)^2 \times \frac{100}{32.6}$ = 1,240 sq. inches = 8.6 sq. ft.

The last portion of the interchange should in reality take place *in the converter itself*, in the neighbourhood of the hottest zone. This can only be determined when the percentage conversion for a given surface or depth of catalyst is known for a velocity of flow of between 30 and 40 ft. per second. The gas leaving the hot zone, say at 550° C., the action being nearly complete, should then pass through a cooler layer of catalyst, so that the equilibrium may adjust itself at the lower temperature, and so cause more complete conversion of CO than could be attained at 550° C. Thus the gases actually leaving the converter and passing to the interchanger will leave at a temperature between 400 and 500° C., the remainder of the interchange being arranged for in the converter itself.

Design for Preheater

It will, anyhow, be necessary to provide a preheater to produce the required temperature in the catalyst furnace for starting up purposes.

The quantity of heat required to raise the $\frac{8{,}200}{15}$ = 545 cu. ft. of water gas per minute for one converter to 460° from 90° C. is 545 × 0.0425 × 0.428 × 370 = 3,660 C.H.U./min.

The quantity of heat required to raise the $\frac{1{,}090}{15}$ = 72.8 lb. of steam for one converter to 460° C. from about 102° C. is 358 × 72.8 × 0.47 = 12,300 C.H.U. per minute.

Total heat to supply for starting one converter = 15,960 C.H.U. per minute, steam and water gas being mixed before entry to the preheater.

Volume of gas = 545 cu. ft. at 20° C. and normal pressure

$$= 545 \times \frac{733}{293} \times \frac{14.7}{16.7} = 1{,}200 \text{ cu. ft. at 460° C. and 16.7 lb. pressure}$$

$$\textit{Volume of steam} = \frac{72.8}{.0213} = 3{,}420 \text{ cu. ft. at 460° C. and 16.7 lb. pres.}$$

$$D = \frac{1.684 \times 16.7}{858 \times 460} = \frac{28.1}{1318} = 0.0213 \text{ lb. per cu. ft.}$$

Total volume = 4,620 cu. ft.

Assuming a maximum velocity of 100 ft. per second in tubes,

$$\text{Cross section} = \frac{4{,}620}{6{,}000} = 0.77 \text{ sq. ft.}$$

If 5 in. tubes are used of area 0.136 cu. ft.,

$$\text{Number of tubes} = \frac{0.77}{0.136} = 6 \text{ (say).}$$

Or two groups of three tubes, *i.e.*, one "unit."

Heat to be transferred = 15,960 × 60 = 957,600 C.H.U. per hr.

Assuming combustion gas enters at 900°, and leaves at 300° C.,

Temperature gradient at one end = 900 − 460 = 440

" " at other end = 300 − 100 = 200 (about)

so that mean temperature gradient

$$= \frac{440 - 200}{2.3 \log \frac{440}{200}} = 303° \text{ C.}$$

Let the transmission be 4 C.H.U. per sq. ft. per °C. per hour, then

$$\frac{957{,}6000}{303 \times 4} = 790 \text{ sq. ft. of heating surface are required.}$$

The heating surface of one tube being 23.35 sq. ft.

$$\text{Number of Tubes} = \frac{790}{23.35} = 33.8$$

or $\frac{33.8}{6}$ = say six tubes in series in each row.

It would be advisable to install four units, one for starting each group of five converters. They could also be thrown into circuit if the autothermic working of any converter was impaired for any reason. These preheaters should be built so that they could be extended at any time if required. They could, indeed, be used for warming the entering gases if the interchangers could not do their work. For five units, assuming the gas to be heated to 200° C. before entry, the heat to be transferred would be

$$5 \times 545 \times 0.425 \times 0.428 \times 210 = 1,045$$
$$+ \ 5 \times 72.8 \times 0.47 \times 198 = 2,380$$

Total heat to be transferred = 3,425 × 60 = 205,500 per hour.

$$\textit{Volume of gas} = 545 \times 5\,\frac{473}{293} \times \frac{14.7}{16.7} = 3,870$$

$$+ \frac{72.8 \times 5}{.033} = 11,000 \text{ cu. ft. at } 200^\circ \text{ C.}$$

Volume of steam

$$D = \frac{1.684 \times 16.7}{392 + 460} = \frac{28.1}{852} = .033 \text{ lb. per cu. ft.}$$

Total volume = 14,870 cu. ft. per minute.

Therefore cross sectional area = $\frac{14,870}{} = 2.48$ sq. ft.

And number of tubes in parallel required

$$= \frac{2.48}{0.136} = \text{about } 18.$$

Mean temperature gradient would be about 455° C. So that

$$\frac{205,500}{455 \times 4} = 113 \text{ sq. ft. of heating surface are required.}$$

And number of tubes = $\frac{113}{2.335}$ = say 5.

To that the heating surface available in one unit would be ample for the whole gas, the six rows (of six tubes in series), being used in parallel for starting, and 18 rows of two tubes (in series), being used in parallel for giving assistance to the interchangers if required.

Size of Mains.

The gas leaving the converters will pass to scrubbers. The temperature will be assumed to be 100° C., some of the heat having been given up to the ingoing water gas in a separate interchanger.

$$\text{Total volume} = \frac{16.7}{15.7} \times \frac{80,800 \times 373}{823} = 39,000 \text{ cu. ft. per min. at } 15.7 \text{ lb. pressure.}$$

It would be better to bring the gas separately from each converter unit of eight or ten converters (so that allowing for loss of 1 lb. pressure in the converters and 60 ft. velocity in the pipes).

Diameter of Mains.

$$\sqrt{\frac{\frac{39,000}{2}}{60 \times 60 \times 0.786}} = 2.62 \text{ ft.} = \text{(say) } 30 \text{ inches.}$$

Design for Scrubbers

Volume of uncondensible gas at 15.7 lb. pressure and 100° C.

$$= \frac{2,132 \times 15 \times 14.7 \times 373}{15.7 \times 823} = 13,500 \text{ cu. ft. per minute.}$$

Therefore, *volume of steam* = 39,000 − 13,500 = 25,500 cu. ft. and its *partial pressure*

$$= 15.7 \times \frac{25.5}{39.0} = 10.25 \text{ lb. per sq. inch.}$$

Steam at this pressure will condense at 92° C.

$$\textit{Weight of uncondensible gas} = \frac{13,500 \times 293}{373} \times \frac{15.7}{14.7}$$

= 11,300 cu. ft. per minute at 20° C. and normal pressure.
= 11,300 × 0.0435.
= 490 lb. per minute.

$$\textit{Weight of steam} = 1,090 - \frac{1,090 \times 39}{300}$$

= 1,090 − 141 = 949 lb. per min.

Heat to remove from gas in cooling, 100° to 50° C. = 490 × 50 × 0.471	=	11,500 C.H.U. per min.
Heat to remove from water vapour, 100° to 92° = 949 × 8 × 0.47	=	3,560 ,, ,, ,,
Heat to remove in condensation, at 90° C. = 949 × 544	=	516,000 ,, ,, ,,
Heat to remove in water, 92° to 50° = 949 × 42 × 1	=	39,900 ,, ,, ,,
Total heat to remove	=	570,960

Mean temperature of gas in scrubbers = 75° C.

$$\text{Volume of uncondensible gas} = \frac{13,500 \times 348}{373}$$

= 12,600 cu. ft. per minute.

So that with a *mean velocity* of 15 ft. per second

$$\frac{12,600}{900} = 14.0 \text{ sq. ft.} = \text{net area through scrubber.}$$

Therefore, *gross area,* if filled with 3 in. pottery rings,

$$= \frac{14.0 \times 100}{400} = 35 \text{ sq. ft.}$$

If the scrubbers are 6 ft. in diameter (and 10 ft. high) = 28.2 sq ft. area.

Number of scrubbers required = 1,24, or (say) 2.

Therefore, *wetter surface* = 2 × 10 ft. × 28.2 × 35 = 19,700 sq. ft.

Wetted surface required (on Hausbrand's jet condenser data),

$$= \frac{590,960 \text{ C.H.U.}}{(100^\circ - 30^\circ) \times 2.8 \text{ (C.H.U.)}} = 2,900 \text{ sq. ft.}$$

These scrubbers ought therefore to be sufficient for the purpose.

Quantity of cooling water required entering at 15° C. and leaving at 45° C.,

$$= \frac{570,960}{30 \times 1} = 19,000 \text{ lb. per minute.}$$
$$= 1,900 \text{ gallons per minute.}$$
$$= 114,000 \text{ gallons per hour.}$$

This is rather a large quantity of water to handle in two scrubbers and it would be well to provide an extra two scrubbers, since the gas might issue from the interchangers at a temperature higher than 100° C.; two scrubbers would suffice for each unit of eight or ten converters. Each scrubber would handle :—

16,400,000 = 4,100,000 = 2,850 cu. ft. of catalysed water gas per day.

The gas (11,400 cu. ft. per minute at 20° C.) leaves the scrubbers, and will pass direct to the iron oxide boxes, and from thence to the storage gasholders for catalysed water gas, which should be of large capacity.

Summary : Water Gas Catalyses.

Two groups of eight or 10 converters required, each with two interchangers. Converters about 8 ft. × 6 ft.

The converters could be made autothermic by attention to detail of design.

One preheater required for each group of five converters.

One scrubber for each group of five converters.

The gas mixed with steam is boosted through the interchangers, through the converters, back through the interchangers, through the scrubbers and thence to iron oxide boxes and gasholder.

The quantity of steam required is 700 tons per day.

Investigations.

Surface velocity relation for catalyst for different steam ratios, temperatures, etc.

Depth of catalyst for different conversions at velocity 30 ft. per second.

Effect of impurities on life of catalyst.

Results with different catalyst support.

Complete design of interchangers and converters.

The Evaporation of Water from Surfaces

Discussion on the Paper by Mr. R. W. Powell and Dr. Ezer Griffiths

OPENING the discussion which followed the joint paper of Mr. R. W. Powell and Dr. Ezer Griffiths on "The Evaporation of Water from Plane and Cylindrical Surfaces," at the Institution of Chemical Engineers on November 8 (THE CHEMICAL AGE, November 30, 1935, page 493), Dr. G. W. HIMUS referred to work carried out by the late Professor Hinchley and himself at the Imperial College of Science, with admittedly crude apparatus, and said that if this matter was looked at from the point of view of hard practical facts it would be agreed that the use of the thermometer was preferable to the use of the thermo-couple, because in practical working it would be very difficult to determine the interface temperature in the way it was being determined by the authors. For instance, in the case of a simple crystallising plant or something of that sort, where a fairly large body of liquid was being dealt with, it was preferable to put the thermometer into the liquid to determine the temperature and to work on the formulæ based on results obtained in that way. With regard to still air evaporation, many experiments had been made from time to time using the thermometer for determining the liquid temperatures. Such experiments were carried out every year at the Imperial College at temperatures up to 60° or 80° C. and vapour pressure conditions up to 400 mm., and it had always been found that the rate of evaporation was proportional to the temperature difference.

A Valuable Feature

One of the most valuable features of the work dealt with in the paper was the study of the evaporation strip by strip transverse to the direction of the wind. The late Professor Hinchley and himself endeavoured to get at the effect of varying the width of the pan in the direction of the draught, but unfortunately they were unable to detect any difference. Another very valuable point dealt with was the edge effect, which might be important. The late Professor Hinchley and himself had endeavoured to look for this and they worked with pans varying from 12 inches wide in the direction of the draught to 1 inch wide in the direction of the draught, and, although there were certain indications of some edge effect, they were unable to detect it at all satisfactorily, the reason being that they were dealing with edge effect on all four sides. He would like to know what would happen in the case of the authors' apparatus in such circumstances.

Temperature Differences

Mr. J. ARTHUR REAVELL, referring to the method adopted by the authors of applying the heat to the strips, said he had done a little work with that method of heating flat surfaces, but he had found the method was not reliable because there was a very distinct difference in the temperatures of the different parts of the surfaces. A great deal of care had been taken to measure the temperatures of the water, but he was asking himself how that would affect the readings if there was irregular heating of the flat surfaces and irregular heating of the cylindrical surfaces. In the work he had done he had found the only method of getting the heat regular throughout was to put some form of fluid heat between the heating strip and the surface. This was with a cylindrical surface, but the same thing applied to flat plates. That seemed to him to be worth looking into because in his own observations it had made a very important difference to the work that was done, and he would be interested to know if there was likely to be anything in that point with regard to the authors' experiments.

Dr. A. J. V. UNDERWOOD remarked that, as the authors had pointed out, it was the surface temperature which determined the rate of evaporation, but it was obviously rather difficult to measure that temperature. The temperature of the body of the liquid might be taken, but not necessarily, to represent the surface temperature, and it might be in a formula on the assumption that there was some obvious relation between the temperature of the body of the liquid and the surface temperature. He did not know whether to assume that, because the relation between the surface temperature and the temperature of the body of the liquid would obviously depend on the convection in the liquid which might cause a very big difference in the relation between the two temperatures. In the case of a relatively mobile liquid, like water, and a relatively viscous liquid, like a concentrated salt solution, it seemed that the method of measuring surface temperature such as the authors had described could hardly be applied in practice, and he was wondering whether the authors could give an indication as to how that problem could be solved.

Half Way to Theoretical Perfection

Professor H. E. WATSON said there were two things to consider in dealing with the evaporation question. On the one hand there was the evaporation from a surface of a liquid of which the temperature was measured in air—and in connection with which the humidity was also measured—and in that way a certain formula could be deduced. The authors, however, had apparently gone half way to the other extreme. There was the theoretical rate of evaporation in which one measured the surface temperature of the water and the humidity of the air and its velocity at an infinitely small distance from the surface, and it seemed to him that that was the measurement which should be made. The authors, however, had measured the surface temperature and apparently the humidity, and in that way had only gone half way towards the theoretical perfection at which they were aiming. Discrepancies were likely to arise in as much as all these measurements were more or less empirical and must depend very much on the apparatus used. Consequently, it was very difficult to compare different measurements made with different apparatus, and it was this which had led to a great deal of confusion when speaking of currents of air passing over a surface.

Mr. N. SWINDIN said a great deal of the available information could not be used because of the difficulty of measuring the surface temperature. As a practical problem, in the case of a pickling tank with perhaps 10 tons of oil, the surface was dancing about all the time and how could one get the temperature at the surface?

An Interesting Experiment

Mr. A. BLACKIE said that most of the experiments done in this connection had been with air passing past the surface although a few had been done in still air, but Griffiths some years ago carried out some experiments on vertical surfaces with convection in still air, and was the first to show the large loss at the surface going to a minimum in some parts and reaching a more or less steady value for the rest. Had anything of the sort been done in connection with evaporation? The change from stream line to turbulent flow was indicated in some of the experiments in the paper with forced draught, but not with natural convection. Another interesting experiment would be to test the evaporation on a horizontal surface on the upper and lower sides. This was a problem which was agitating heat transfer people very much at present. They desired to know the exact conditions of the ratios of the losses on the upper and the lower surfaces with natural convection, and it was quite possible that light might be thrown upon that problem to some extent by experiments in evaporation in the same way.

Mr. F. J. BAILEY asked why the vapour pressure difference

in these experiments was limited to 50 mm., because it seemed to him that by going a good deal farther it might be possible to ascertain a good deal more about the relationship between one thing and another. He also inquired why the authors had taken a vertical cylinder down which it would not be tremendously difficult to stream a free film of water, and then had wrapped it up in blotting paper to keep the water on the surface.

Mr. M. B. DONALD referred to the statement in the paper that "it has been established by aerodynamic research that for the case in which a cylinder is placed with its axis at right angles to the direction of the wind stream, the air flow in the immediate vicinity of the front surface of the cylinder is laminar or stream line," and added that, although the authors had taken great care to get the air stream line before it reached the cylinder, he did not see why that should come in. On another point, he said that in the case of heat transfer from a cylinder, if the Reynolds number was put up high enough it was possible to get more heat transfer from the back than from the front. He wondered what had influenced the authors to select the particular velocities they had worked at; was it something to do with the velocity one usually saw in refrigeration or not?

Dr. GRIFFITHS said the discussion had been most helpful to the authors in suggesting further lines of work. Speaking generally, he said it was a fundamental in science to confine oneself to conditions in which there were not too many variables. He admitted that the practical man was concerned with the temperature of the body of the liquid, but unless he knew that that bore some relation to the temperature at the surface, he was not progressing very much in his work. The authors had not wished to measure the surface temperature for the sake of it, but they realised at the outset that that was the temperature which mattered.

Letters to the Editor

Intelligence—Wanting Everywhere

SIR,—Dr. S. H. Tucker, in his lecture to the Andersonian Chemical Society (THE CHEMICAL AGE, November 30, pp. 487-488), but expresses the general feeling that modern education is a bar to progress, without relation to the needs of life. Our society would seem to be in conspiracy against itself. We do our best, in our schools, to kill out what little intellectual leadership is in our ranks; in fact, everything is done to prevent really thinking men from arising. We are so utterly commercialised, that we suffer our children's souls to be sold without the least count of cost. The Chinese, in the past, have mercilessly bound the feet of their women: now that they are abandoning the practice, our women have taken it over, with the lipstick. The English female parent can therefore suffer anything in unreason. In our schools, we are everywhere allowing the hairs of intelligence to be plucked from infantile eyebrows, assuming the effect to be ornamental: the result is a mask of enforced dullness.

Dr. Tucker is but one of many voices crying in the wilderness of public impotence. The Vice-Chancellor of Sheffield University, Dr. Pickard-Cambridge, when speaking at Norwich at the recent meeting of the British Association (THE CHEMICAL AGE, September 21), in Section 'ell, minced no words in his criticism of the effect of examinations; there must have been premonition thirty odd years ago when such alphabetic rank was assigned to the Section. The poor public is powerless, in face of the established conventions and the closed mind of the teaching fraternity: the situation is described by *Fury*, in *Prometheus Unbound*:

> "The good want power but to weep barren tears.
> The powerful goodness want; worse need for them.
> The wise want love and those who love want wisdom
> And all best things are thus confused to ill.

Muddle reigns supreme—nothing in intellectual education is now thought out to a logical end.

Even Professor Smithells, one of the most inoffensive and mildest mannered of men, was moved to wrath, a few weeks ago (THE CHEMICAL AGE, November 23), in his "inabsentiated" address to the Pharmaceutical Society. He fully supported Dr. Pickard-Cambridge's denunciation of the present vicious control of the schools by outside examining bodies.

> "That dog to serve some private end
> Went mad and bit the man."

Pasteur, just fifty years ago, introduced his well-known method of preventive inoculation, with an attenuated virus, as a cure for Rabies. We need to apply the method in education. Unless some Pasteur, still better a Lord Fisher, arrive to introduce a cure against the madness of examination now dragging down our schools, of whatever grade, at no distant date, intellectual bankruptcy must be our fate. I have watched the disease ever growing in intensity during the whole of my life. We know the incalcuable harm done in the past by the Inquisition: this is with us in a far worse form to-day. Some measure of morality must be introduced into teaching if ever freedom of thought is to prevail.

The crux of the situation, the fundamental cause of our educational demoralisation and downfall, is expressed in a paragraph early in Dr. Tucker's address in the one short word, FEES.

This is a word of most terrible import, more terrible in its implications than any other in our language. They are the private end to serve which the educational dog is gone mad. Abolish fees, no one outside a school will wish to examine: in honest truth, there is no other reason for their being. Examining is a great modern discovery, as one of the easiest (though tedious and demoralising) and most remunerative of businesses to all concerned—excepting those submitted to the torture.

The London University, so-called—for it never has been an University nor ever will be one, in real effect—lives a barefaced existence on Matriculation fees—mostly paid for no privilege to be taught in the University nor on account of any educational advantage but just as a Certificate—of what? Mistaken teaching! It has bred a crowd of examiners, coaches and crammers. Examinations are now an unholy, festering sore upon education, misdirecting it in every way, possible and impossible. There is no morality behind them as they are conducted. They make learning and sound teaching impossible. Witness—Dr. Pickard-Cambridge and Professor Smithells. Of the many industries that are practised to-day that are amoral, not few in number, because their goods are false, the examination industry is the most far reaching and damnable in its results. Unless and until we recognise this and abolish it, root and branch, all efforts to develop intelligence in schools must be in vain. Neither experiment nor progress is possible under the system. To secure the needed changes will be very difficult, the vested interests are so many and so powerful: the body of ignorance to be overcome so great.

The difficulty is deep seated. We are essentially creatures of faith, not of reason. Modern science, so-called, in the main is merely a new department of the Church, a new religion, differing only in its ritual from those recognised up to recent times—another doxy. The young chemist is never taught the method of discovery: to reason why; to doubt all statements not open to verification; instead he is brought up in the gospel according to this or that saint of his church. The Freethinker is almost unknown, despised and rejected of men, if he appear on the scene—unless he promulgate a new doxy. We laugh at the multitude of churches in the United States—they are just as numerous in the field miscalled Science.—Yours faithfully,

H.E.A.

Notes and Reports from the Societies

British Association of Chemists

Manchester Section : Manufacture of Sulphuric Acid

A LECTURE on "The Manufacture of Sulphuric Acid" was given by Mr. W. M. Coates, B.Sc., and Mr. F. Shackleton, before a well attended meeting of the Manchester Section of the British Association of Chemists, at Accrington, on November 22. After outlining the historical development of sulphuric acid manufacture, the lecturers proceeded to discuss and criticise the erection and working of modern chamber plant, particularly in relation to efficiency and economy of first cost and operation. The purification and concentration of the acid were also dealt with. The lecturers acknowledged their indebtedness to Mr. J. F. Carmichael for the loan of slides illustrating modern chamber plant in course of erection and in operation, and to the directors of J. Riley and Sons, Ltd., chemical manufacturers, Hapton, for permission to read the paper.

Society of Chemical Industry

Yorkshire Section : Analytical Disintegrator for Coal

A VACUUM percussion disintegrator and its use for the separation of plant remains from coal was described by Mr. J. C. McCrae, B.Sc., A.I.C., and Mr. A. M. Wandless, M.A., in a paper read before the Yorkshire Section of the Society of Chemical Industry at Hull on November 19. Plant remains, said the joint authors, suffered oxidation on being separated from coal by chemical means, but the spore exines, having a low specific gravity, could be separated from suitably prepared coal by water-elutriation. The ordinary methods of grinding, however, did not yield the spore exines free from associated material. A vacuum percussion disintegrator had been designed which had successfully reduced ¼ inch durain rich in spore exines so as to give the bulk of its megaspore exine content in the 30-60 I.M.M. fraction of the disintegrated product. The disintegrator consisted of a cone having five series of short radial arms. The cone was rotated at 1,200 to 1,800 r.p.m. and was fitted with a conical cover which was bolted down over the revolving cone and evacuated. Inside the cover was a series of five stationary cylinders arranged so that the coal, dropping from a hopper at the apex of the cover, was impelled outwards by the revolving arms to strike the stationary cylinders, and then fell downwards to be struck again by the succeeding circle of revolving arms.

An elutriator treating intermittent 100 gm. charges of closely sized coal provided fractions increasing in specific gravity by 0.01 for each 6 cm. per minute (60 ml. per minute) increase in water speed. Coal prepared in a coffee mill yielded a light fraction of 8 per cent. consisting of a concentration of particles containing megaspore exine in matrix, while coal prepared in the disintegrator yielded a light fraction of 1 per cent. consisting almost entirely of pure megaspore exine fragments and a second fraction of 8 per cent. containing 95 per cent. of plant remains. These two combined fractions showed a volatile matter content of 65 per cent.

Chemical Society

Interaction between Gases and Solids

THE literature pertaining to the subject of the interaction of gases with solids is one of the most extensive in physical chemistry. In spite of this, it cannot be said that the problems, experimental and theoretical, have been completely solved. The urgent need is for new methods of attack. At the Chemical Society on November 21, Professor E. K. Rideal opened a discussion by surveying the whole field of inquiry in order to show at what points the new methods are proving useful in current investigations.

One of the great experimental difficulties in surface chemistry is to obtain a surface of known constitution. With metals this is most readily accomplished with tungsten, for the surface may be cleaned by flashing a filament to at least 2,000° K in vacuo. Roberts ("Proc. Roy. Soc.," 1935, *152*, 445) has developed a method for detecting the formation of surface films on tungsten by using the accommodation coefficient of neon as an indicator. The cleaner the surface, the smaller the accommodation coefficient, an oxygen film, for example, raising the accommodation coefficient from 0.07 to 0.25 at room temperature. At the same time a technique has been devised for measuring the heat of adsorption on a single filament by determining the rise in temperature on adsorption of the gas. Provided a clean surface is used, Roberts has found that hydrogen is very quickly chemisorbed even at liquid air temperatures. In order to get the hydrogen off again, it is necessary to heat the filament to 700° K. Furthermore, no less than 40 kg. cal. are evolved on adsorption. Hitherto the slow uptake of hydrogen by metals at elevated temperatures, or activated adsorption as it is usually termed, has invariably been observed with metallic powders, tungsten included, which cannot be heated to high temperatures to obtain a clean surface. Roberts's experiments would indicate that activated adsorption is not the true chemisorption of hydrogen on a clean metal surface, but some other process, such as the diffusion of hydrogen into the body of the metal, already superficially covered with a layer of gas.

Observations with Oxygen

Similar observations have been made with oxygen. After the first well-known layer of oxygen atoms is formed on the surface, again at liquid air temperatures, a layer of *molecules* is adsorbed on top of the atoms, covering about 8 per cent. of the surface. The reason for the formation of the second layer, which is stable up to relatively high temperatures (400° K), is as follows: When oxygen molecules collide with a bare surface they are dissociated to atoms, each atom being attached to one tungsten atom. Therefore before an oxygen molecule can be adsorbed there must be available two adjacent bare tungsten atoms. As the surface gradually becomes covered with oxygen, isolated atoms of tungsten are left and it is at these places that oxygen molecules are adsorbed.

An important question in surface chemistry is the mobility of adsorbed atoms on a surface. Bosworth ("Proc. Roy Soc.," A, 1935, *150*, 58) has followed the migration of sodium atoms on tungsten by shooting sodium ions on to a tungsten strip and following the progress of the migration by determining the photoelectric activity of the strip at various distances from the position at which the sodium atoms were initially deposited. By varying the temperature of the strip, the energy of activation for migration may be computed, and by varying the surface concentration the influence which the adsorbed atoms exert on each other may be investigated.

Diffusion from the Surface

Diffusion from the surface of an adsorbent into its interior is a factor of great importance in surface phenomena. The process is generally specific, as in the diffusion of hydrogen through metals, but a non-specific type of diffusion is found in the passage of hydrogen and the rare gases through silica glass (Barrer, "J. Chem. Soc.," 1934, 378). The opposition to diffusion is due to the operation of van der Waals *repulsive* forces between the inert gas atoms and the silicon and oxygen atoms of the glass. Calculation, too, shows that these repulsive forces may reach very high values if the spacing of the atoms is of the right order. Oxygen and nitrogen,

on the other hand, appear to diffuse through imperfections, for the rate is markedly sensitive to surface treatment and firing of the silica glass.

Further information on the vexed question of the mechanism of catalytic hydrogenation and dehydrogenation is provided by the investigation of the exchange reaction of deuterium with hydrides, using the ortho-para conversion as an indicator of the rate of dissociation of deuterium molecules. Ammonia, for example, exchanges with deuterium in presence of an iron catalyst. The rate of the ortho deuterium conversion is inhibited by adsorption of the ammonia, but, in addition, the rate of exchange is slower than the ortho-para conversion, showing that the exchange rate is not governed by the rate of dissociation of deuterium molecules.

Personal Notes

MR. J. H. MAKINSON, of Peterborough, retired iron merchant, left £32,538, with net personalty £18,408.

MR. A. W. ALLEN, of Derbyshire, late mineral manager of the L.M.S. Railway, left £17,207, with net personalty £14,527.

MR. A. WATT, joint secretary of T. and H. Smith, Ltd., manufacturing chemists, Edinburgh, has been admitted a member of the Edinburgh Merchant Company.

MR. P. K. FROLICH, formerly director of the Esso Laboratories, has been made chief chemist of the Standard Oil Development Co.

MR. J. P. E. C. STROMEYER, O.B.E., M.INST.C.E., of Manchester, a member of the council of the National Physical Laboratory, left £5,612, with net personalty £3,073.

DR. E. W. SHAW, chief geologist of the Iraq Petroleum Co., formerly of the United States Geological Survey, died on October 7, aged fifty-four years.

DR. W. K. LEWIS has been awarded the Perkin Medal of the Massachusetts Institute of Technology. The medal is awarded annually for the most valuable work in applied chemistry.

DR. J. F. TOCHER, F.I.C., proposed the toast of "The Guest" at the dinner of the Aberdeen and North of Scotland Section of the Institute of Chemistry, which was held in Aberdeen on November 21.

MR. J. A. MOFFETT, vice-president of the Standard Oil Co., of California, stated on November 30 that "the American oil companies will desist from selling oil to Italy if the Government requests it."

DR. E. J. PARRY was among those who were formally admitted to the degree of Doctor of Science in the University of London on November 21. The Chancellor of the University (the Earl of Athlone) presided at the ceremony.

MR. W. A. O'FLYNN, one of the most prominent mining men in Ontario, is reported to have died in Toronto, aged sixty. He was a director of the Ontario Mining Association and a member of the Canadian Institute of Mining and Metallurgy.

MR. W. J. GARDNER, managing director of Meltham Silica Firebrick Co., Ltd., manufacturers of coke-oven refractories, has been elected a director of Usines Belges de la General Refractories, Seilles-Andenne, Belgium, where it is proposed shortly to commence the manufacture of silica bricks and coke oven refractories.

MR. R. W. NEWSON, constructional engineer, who has supervised the building of the coal-oil plant at Seaham for Coal and Allied Industries, Ltd., has been made a presentation by the staff to mark the completion of the work. The gift was handed over by Mr. J. Cain, constructional foreman.

CONSUL HUGO SACHS, founder and chairman of the Vereinigte Wildstein-Neudorfer Tonwerke A.G. in Eger, and the well-known pulverisation and sifting works, Alpine A.G., at Augsburg, and other undertakings, has been decorated with the Greek order "Croix d'Or du Phénix." Herr Sachs enjoys considerable esteem both in Germany and elsewhere, and the news of the honour conferred upon him has been received with general satisfaction.

LORD RUTHERFORD will open the new research laboratory of the L.M.S. Railway Co., at Derby, on Tuesday afternoon.

MR. S. BARLOW, of Trehalt, Goonhavern, Perranzabuloe, who for some years had been engaged at Treamble Works, died at the Royal Cornwall Infirmary, Truro, on November 29.

MR. R. S. MORGAN, D.SC., of Cheshire, a research chemist, and a member of the chemical research staff of Lever Brothers, Ltd., left £1,349, with net personalty £1,205.

SIR F. GOWLAND HOPKINS delivered his presidential address at the anniversary meeting of the Royal Society in London on November 29. He dealt with the problems of nutrition.

MR. A. W. BUSH, of Hackney, manufacturing chemist, joint managing director of W. J. Bush and Co., Ltd., who died on August 3 last, aged 69 years, left estate of the gross value of £157,419, with net personalty £135,492.

PROFESSOR C. FABRY, of the Institut d'Optique, Paris, gave the Thomas Young Oration of the Physical Society at the Imperial College of Science on December 6. The title of his lecture was "Vision in Optical Instruments."

MAJOR F. A. FREETH will give a talk on the "Making and Use of Hydrogen," on January 2, at the Imperial Institute, as part of the programme for the Schoolboys Own Exhibition. MR. J. DAVIDSON PRATT will lecture the same day on "Gas Defence."

MRS. JAMES DARCY LEVER, widow of the younger of the Lever brothers, who founded the soap firm of that name, died last week at her London residence after a long illness. Daughter of the late Dr. Kershaw, of Bolton, Lancashire, she married James Darcy Lever, co-founder with his brother, William Hesketh Lever, the first Lord Leverhulme, of the business of Lever Brothers, Ltd. She was at her husband's side at the cutting of the first sod of Port Sunlight in 1888, and W. H. Lever publicly acknowledged in the speech-making which followed the ceremony the good fortune which had guided him and his brother in their choice of wives. J. D. Lever was closely associated with his brother in the development of the business until illness overtook him some years before his death in 1910. During that time Mrs. Lever took a deep and active interest in the life of the Port Sunlight community, and particularly in matters affecting the welfare of the women workers. Mrs. Lever, who is survived by two daughters and a son, lived for a long time at Thornton House, Thornton Hough, Cheshire. Of recent years she resided in London.

GERMAN trade in ultramarine has recorded less favourable results this year, and the outlook for the industry is not considered encouraging. Reasons cited for the decline are decreased demand brought about by the cessation of Government subsidies for house painting and other repair work, together with a shortage of imported linseed and other drying oils for making paints, in which ultramarine is used. In addition, ultramarine imports suffered from foreign price competition. While exports of ultramarine from Germany totalled 596 metric tons for the first eight months of 1935, as compared with the respective quantities of 471 and 514 metric tons for the corresponding periods of 1934 and 1933, volume gains were achieved through price reductions.

Continental Chemical Notes

Esthonia

PLANS FOR AN ENORMOUS INCREASE in shale oil output are expected to result in a production figure of 120,000 tons in 1936/7 (as compared with the 1934 figure of 45,000 tons).

Jugoslavia

THE CARBIDE AND CYANAMIDE WORKS of the Dalmatienne concern, which have been at a standstill for some time, are to resume production.

Hungary

TEXTILE CHEMICALS ARE TO BE MANUFACTURED by the Budapest house of Müller, on the basis of a Czechoslovakian process.

THE ERECTION OF A CELLULOSE FACTORY is planned by the Nemeny Paper Works at Csepel, according to a Budapest report.

Sweden

FURTHER EXPANSION IN THE RAYON INDUSTRY is anticipated in consequence of the projected erection of another rayon works. The proposed site of the new enterprise (for which attempts are being made to raise a government loan of 750,000 crowns) is in the province of Bohns and the contemplated initial daily output of two tons will be subsequently increased to four tons.

Russia

CRYSTALLINE META-PHENYLENE DIAMINE is prepared by distillation of zinc chloride double salt with an alkaline carbonate (Russian Pat. 34,552).

TO BENZYLATE AROMATIC AMINES, it is proposed to heat with benzyl chloride in presence of an acid eliminant such as carbonates or alkaline or alkaline earth oxides. The reaction should be carried out in the absence of water (Russian Pat. 34,553).

Czécho-Slovakia

RUBBER CULTIVATION TRIALS have been proceeding in Czecho-Slovakia for several years, reports the "Prager Birsen-Courier." Certain plants have now been selected for more extensive trials under the joint auspices of the Bata concern and the Government experimental station at Pruhonice.

Greenland

STATISTICS OF CRYOLITE EXPORTS ("Chemische Industrie," November 29) reveal that nearly one-half of the 1934 output of 15,000 tons was consigned to the Copenhagen concern, Oresunds Chemiske Fabriker, whilst a considerable proportion was sold to the Pennsylvania Salt Manufacturing Co., of Philadelphia.

Germany

CHOLESTEROL—BORIC ACID COMPOUNDS which liberate the acid after application to the skin—have been patented for cosmetic purposes. These esters are soluble in ether, chloroform and other solvents and insoluble in water, liberating the free acid on contact with the latter. In one example of the preparation, 1 part boron triacetate is added to 5.7 parts melted cholesterol and the acetic acid driven off in a vacuum by gradually raising the temperature to 218° C. The clear melt solidifies on cooling to a glassy mass which dissolves in alcohol, ether and chloroform (German Pat. 621,916).

AMINO DERIVATIVES OF THE PHYTOSTEROL GROUP of substances (which are easily isolated from elemi resin) are reported to differ from the parent substance in being therapeutically active. They act as reducers of blood pressure and offer an advantage over acetyl choline and other blood pressure reducing agents in common use in being effective in smaller doses. An example is alpha amyriramine ($C_{30}H_{05}N$) which is prepared from the sterol, alpha-amyrone, by successive conversion to the oxime and reduction with sodium (German Pat 621,914).

Coal and Allied Industries

Working Results of Plant

A CIRCULAR to the shareholders and holders of options on shares of Coal and Allied Industries has now been issued, giving the results of the working of the Seaham Harbour plant up to the present time.

Crude oil resulting from a throughput of 360 tons of coal-oil paste during the twelve days to November 24 amounted to 24,900 gal. In addition, 150 tons of semi-coke were produced. The refinery was put into operation on November 22, and the crude oil products are now being treated. It has been found that better results are obtained by using one ton of oil to every ton of coal instead of a half-ton of oil to every ton of coal. When the present battery of 51 ovens is in full operation, states the circular, the crude oil production (it is estimated) will be 33,000 gal. per day from a throughput of 320 tons of coal-oil paste. Treatment of the crude oil should result in not less than 2,960 gal. of aviation spirit, 1,392 gal. white spirit, 1,968 gal. heavy white spirit, 5,888 gal. Diesel oil, and 16,640 gal. of heavy oil returned for mixing with coal. In addition there will be 136 tons of semi-coke and various chemical products.

Provided the necessary finance is forthcoming, the board has decided to construct an additional carbonising battery and to enlarge the chemical treatment plant. With a view to providing further resources for the company's requirements, an advance of £37,340, free of interest, has been made to the company, which is to be satisfied by the issue of 31,500 shares.

Fire Resistance Research

A New Testing Station for Materials and Appliances

THE new testing station of the Fire Offices Committee at Boreham Wood, Elstree, which has been built for the purpose of examining and testing various appliances, such as sprinkler heads, sprinkler valves, portable fire extinguishers and automatic fire alarms, and of assessing the fire-resisting qualities of floors, walls, columns and the other elements in the construction of a building was opened by the Duke of Kent last week.

Mr. A. S. Hinshelwood, chairman of the committee, described the history of the station's development and the foundation of the present building. The purpose of the station was, he said, to enable manufacturers of building materials to obtain tests of their products in accordance with the standards of fire resistance and in incombustibility laid down for elements of structure by the British Standards Institution.

The main fire-testing building contains three furnaces, each capable of testing specimens of the dimensions required by British Standard Specification 476. The temperatures range from 1,000° to 2,200° F. and the periods of exposure from half an hour to six hours. Special machinery, working under pressure up to 4,500 lb. per square inch, has been provided for applying the necessary load to the wall and column specimens while under test, and to meet the requirements of this machinery the furnaces have been made mobile and mounted on rails. An interesting feature is that all the many controls and recording instruments have been centred in one room.

Chemical and Allied Stocks and Shares

Movement to Lower Prices

THERE has been a moderate movement to lower prices in leading industrial shares and shares of chemical and associated companies have moved with the general tendency. There have been numerous steady features among the latter, although with few exceptions (such as Fison, Packard and Prentice, which held their recent rise) they are shares that do not enjoy an active market and do not therefore react quickly to market conditions. Imperial Chemical are nearly 1s. down at the time of writing and now yield as much as nearly 4½ per cent., which appears unduly generous for a prominent industrial. Moreover some market men remain hopeful of a small increase over last year's 8 per cent. dividend, although it is realised this may turn on international trade conditions over the next few months and that it has been officially indicated that it is the intention to continue to place a good proportion of the profits back into the business. Cooper, McDougall and Robertson continued to hold the better price made recently. Salt Union were relatively steady. The last report showed an increase in net profits from £166,138 to £176,983—the best since 1929 when the figure was £178,243 and the dividend 12½ per cent. For each of the past five years the dividend has been limited to 9 per cent. The market is hopeful of an increase to possibly 10 per cent. for the current year. United Premier Oil and Cake ordinary shares were active at a higher level. Last year well over twice the dividend of 7½ per cent. was earned on the shares, and as interim dividends have been resumed with a payment of 4 per cent., hopes of a 10 per cent. dividend or more are being entertained. United Molasses were lower, but this was attributed to general market conditions. The past year's results created an excellent impression, and the report and meeting are awaited with interest. Distillers have also moved up, partly on the Molasses results and partly on the unofficial news that arrangements have been made to market a large block of shares which was overhanging the market. The interim dividend falls to be announced in the first half of January. It is expected it will be kept at 7½ per cent., as for many previous years, and the question of an increase left until the final payment, in accordance with the usual conservative policy of the directors. British Oxygen ordinary units were in better demand, partly on the news that the company is contemplating erecting a factory near Fort William, Inverness, in connection with which the British Aluminium Co. may provide hydro-electric requirements. Imperial Smelting were rather more active on the belief that if zinc prices favour the company there are possibilities of the shares entering the dividend list in 1936. Goodlass Wall and Lead Industries held up quite well. In this case the market is looking for an increase over last year's 6 per cent. dividend. British Cyanides have lost a few pence and are now around 3s., at which these 2s. shares give an apparently satisfactory yield on the basis of last year's 8 per cent. dividend. British Glues retained nearly all their rise of the past few weeks.

Name.	Dec. 3.	Nov. 26.
Anglo-Iranian Oil Co., Ltd. Ord.	68/1½	70/-
,, 8% Cum. Pref.	37/3	37/-
,, 9% Cum. Pref.	38/3	38/3
Associated Dyers and Cleaners, Ltd. Ord.	2/6	2/6
,, 6½% Cum. Pref.	5/3¾	5/3¾
Associated Portland Cement Manufacturers, Ltd. Ord.	65/6	67/-
,, 5½% Cum. Pref.	28/-	28/-
Benzol & By-Products, Ltd. 6% Cum. Part Pref.	2/6	2/6
Berger (Lewis) & Sons, Ltd. Ord.	65/1½	65/-
Bleachers' Association, Ltd. Ord.	6/3	7/6
,, 5½% Cum. Pref.	11/10½	12/6
Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)	20/-	20/-
Boots Pure Drug Co., Ltd. Ord. (5/-)	49/-	49/-
Borax Consolidated, Ltd. Pfd. Ord. (£)	100/-	100/-
,, Defd. Ord.	17/6	17/9
,, 5½% Cum. Pref. (£10)	£11/2/6	£11/2/6
,, 4½% Deb. (1st Mort.) Red. (£100)	£109	£109
,, 4½% 2nd Mort. Deb. Red. (£100)	£102	£102
Bradford Dyers' Association, Ltd. Ord.	10/7½	10/7½
,, 5% Cum. Pref.	12/6	13/1½
,, 4% 1st Mort. Perp. Deb. (£100)	£88	£88
British Celanese, Ltd. 7% 1st Cum. Pfd.	25/6	25/9
,, 7½% Part 2nd Cum. Pref.	22/6	23/6
British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)	6/3	6/3
,, 4% 1st Mort. Deb. Red. (£100)	£94	£94
British Cyanides Co., Ltd. Ord. (2/-)	3/-	3/3
British Drug Houses, Ltd. Ord.	18/9	18/9
,, 5% Cum. Pref.	21/3	21/3
British Glues and Chemicals, Ltd. Ord. (4/-)	7/3	7/3
,, 8% Pref. (Cum. and Part.)	28/1½	28/1½
British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.	48/9	49/4½
,, 5½% Cum. Pref.	26/3	26/3
,, 4½% First Mort. Deb. Red. (£100)	£108/10/-	£106/10/-
British Oxygen Co., Ltd. Ord.	112/6	113/9
,, 6½% Cum. Pref.	32/6	32/6
British Portland Cement Manufacturers, Ltd. Ord.	87/6	90/-
,, 6% Cum. Pref.	30/6	30/6
Bryant & May, Ltd. Pref.	66/3	66/3
Burt, Boulton & Haywood, Ltd. Ord.	20/-	20/-
,, 7% Cum. Pref.	27/6	27/6
,, 6% 1st Mort. Deb. Red. (£100)	£105/10/-	£105/10/-
Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)	108/9	108/9
,, 4% 1st Mort. Deb. Red. (£100)	£96/10/-	£96/10/-
Calico Printers' Association, Ltd. Ord.	9/4½	10/7½
,, 5% Pref. (Cum.)	15/11	16/3
Cellulose Acetate Silk Co., Ltd. Ord.	13/4	14/-
,, Deferred (1/-)	2/4½	2/4½
Consett Iron Co., Ltd. Ord.	10/9	11/-
,, 8% Pref.	28/9	28/9
,, 6% First Deb. stock, Red. (£100)	£107/10/-	£107/10/-

Name.	Dec. 3.	Nov. 26.
Cooper, McDougal & Robertson, Ltd. Ord.	36/3	36/3
,, 7% Cum. Pref.	30/-	28/9
Courtaulds, Ltd. Ord.	55/7½	55/7½
,, 5% Cum.	26/3	26/3
Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre-Pref.	25/-	25/-
,, Cum. 6% Pref.	28/9	28/9
,, 6½% Cum. Pref.	30/7½	30/7½
,, 7½% "A" Cum. Pref.	30/7½	30/7½
Distillers Co., Ltd. Ord.	97/6	96/-
,, 6% Pref. Stock Cum.	31/6	31/6
Dorman Long & Co., Ltd. Ord.	21/10½	21/3
,, Pref. Ord.	29/4½	28/9
,, 6½% Non-Cum. 1st Pref.	23/3	23/6
,, 8% Non-Cum. 2nd Pref.	22/3	21/3
,, 4% First Mort. Perp. Deb. (£100)	£102/10/-	£102/10/-
,, 5% 1st Mort. Red. Deb. (£100)	£106/10/-	£107
English Velvet & Cord Dyers' Association, Ltd. Ord.	5/-	5/-
,, 5% Cum. Pref.	8/9	8/9
,, 4% First Mort. Deb. Red. (£100)	£73/10/-	£73/10/-
Fison, Packard & Prentice, Ltd. Ord.	43/9	43/9
,, 7% Non-Cum. Pref.	31/3	31/3
,, 4½% Debs. (Reg.) Red. (£100)	£106	£106
Gas Light & Coke Co., Ord.	28/-	28/-
,, 3½% Maximum Stock (£100)	£89/10/-	£89/10/-
,, 4% Consolidated Pref. Stock (£100)	£106/10/-	£106/10/-
,, 3% Consolidated Deb. Stock, Irred. (£100)	£90	£89/10/-
,, 5% Deb. Stock Red. (£100)	£114/10/-	£116/10/-
,, 4½% Red. Deb. Stock (1960-65) (£100)	£112/10/-	£113/10/-
Goodlass Wall & Lead Industries, Ltd. Ord. (10/-)	14/4½	14/4½
,, 7% Prefd. Ord. (10/-)	13/9	13/9
,, 7% Cum. Pref.	28/9	28/9
Gossage, William, & Sons, Ltd. 5% 1st Cum. Pref.	24/4½	24/4½
,, 6½% Cum. Pref.	28/9	28/9
Imperial Chemical Industries, Ltd. Ord.	36/9	37/3
,, Deferred (10/-)	9/-	9/1½
,, 7% Cum. Pref.	33/-	33/6
Imperial Smelting Corporation, Ltd. Ord.	15/-	15/-
,, 6½% Pref. (Cum.)	24/-	24/3
International Nickel Co. of Canada, Ltd. Cum.	$41½	$39½
Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)	105/-	105/-
,, 4% Mort. Deb. Red. (£100)	£98/10/-	£98/10/-
Laporte, B., Ltd. Ord.	116/3	118/9
Lawes Chemical Co., Ltd. Ord. (1/-)	6/3	6/3
,, 7% Non-Cum. Part Pref. (10/-)	10/-	10/-
Lever Bros., Ltd. 7% Cum. Pref.	31/6	32/-
,, 8% Cum. "A" Pref.	33/-	33/-
,, 20% Cum. Prefd. Ord.	77/6	78/1½
,, 5% Cons. Deb. (£100)	£106/10/-	£106
,, 4% Cons. Deb. (£100)	£103/10/-	£103

Name.	Dec. 3.	Nov. 26.
Magadi Soda Co., Ltd. 12½% Pref. Ord. (5/-)	1/3	1/3
,, 6% 2nd Pref. (5/-)	6d.	6d.
,, 6% 1st Debs. (Reg.)	£12/10/-	£10
Major & Co., Ltd. Ord. (5/-)	7½d.	7½d.
,, 8% Part. Prefd. Ord. (10/-)	9d.	9d.
,, 7½% Cum. Pref.	1/6¾	1/6¾
Pinchin, Johnson & Co., Ltd. Ord. (10/-)	43/-	43/6
,, 1st Pref. 6½% Cum.	32/-	32/-
Potash Syndicate of Germany (Deutsches Kalisyndikat G.m.b.H.) 7% Gld. Ln. Sr. "A" and "B" Rd.	£71	£70
Reckitt & Sons, Ltd. Ord.	116/3	116/10½
,, 4½% Cum. 1st Pref.	24/4½	25/-
Salt Union, Ltd. Ord.	43/9	43/9
,, Pref.	45/-	45/-
,, 4½ Deb. (£100)	£109/10/-	£109/10/-

Name.	Dec. 3.	Nov. 26.
South Metropolitan Gas Co. Ord (£100)	£133/10/-	£135/10/-
,, 6% Irred. Pref. (£100)	£149/10/-	£149/10/-
,, 4% Pref. (Irred.) (£100)	£107	£107
,, Perpetual 3% Deb. (£100)	£89/10/-	£88/10/-
,, 5% Red. Deb. 1950-60 (£100)	£116/10/-	£116/10/-
Staveley Coal and Iron Co., Ltd. Ord.	46/10½	46/10½
Stevenson & Howell, Ltd. 6½% Cum. Pref.	26/3	26/3
Triplex Safety Glass Co., Ltd. Ord. (10/-)	83/1½	82/6
Unilever, Ltd. Ord.	30/-	31/3
,, 7% Cum. Pref.	29/3	28/9
United Glass Bottle Manufacturers, Ltd. Ord.	44/-	44/-
,, 7½% Cum. Pref.	33/-	33/-
United Molasses Co., Ltd. Ord. (6/8)	20/-	21/3
,, 6% Cum. Pref.	25/-	25/-
United Premier Oil & Cake Co., Ltd. Ord. (5/-)	10/-	8/9
,, 7% Cum. Pref.	25/-	24/4½
,, 6% Deb. Red. (£100)	£102/10/-	£102/10/-

Inventions in the Chemical Industry

Patent Specifications and Applications

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications open to Public Inspection

ANHYDROUS MAGNESIUM CARBONATE (magnesite), process for the production.—I. G. Farbenindustrie. May 19, 1934. 9584/35.

BROMINATION PRODUCTS of vat dyestuffs, manufacture.—Soc. of Chemical Industry in Basle. May 19, 1934. 13118/35.

OIL-SOLUBLE PHENOLIC CONDENSATE.—I. Rosenblum. May 19, 1934. 14368/35.

APPARATUS for the manufacture and production of oleum.—I. G. Farbenindustrie. May 24, 1934. 14584/35.

CALCINED TITANIUM OXIDE PIGMENTS, preparation.—Titan Co., Inc. May 19, 1934. 14605/35.

ACID DYESTUFFS of the anthraquinone series, manufacture.—I. G. Farbenindustrie. May 19, 1934. 14711/35.

TESTING GASES by chemical means, apparatus.—P. L. L. Vallery and J. F. P. Rosello. May 23, 1934. 14715/35.

VINYL DERIVATIVES, production.—Kodak, Ltd. May 23, 1934. 14736/35.

SYNTHETIC RESINS and compositions containing the same.—E. I. du Pont de Nemours and Co. May 24, 1934. 15251/35.

PROCESS FOR MAKING SODIUM SULPHIDE from sodium sulphate by reduction with hydrogen or other reducing gases.—A. Zieren. May 25, 1934. 15429/35.

Specifications Accepted with Date of Application

EXTRACTION OF NOBLE METALS by leaching out with cyanide.—G. Siegle and Co., Ges., and W. König. May 10, 1934. 438,358.

ORTHO-OXYAZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 10, 1933. 438,131.

ACID DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 11, 1933. 438,426.

COUMARIN, manufacture.—L. Givaudan and Cie, Soc. Anon. May 12, 1933. 438,361.

BENZIDINE and its homologues and derivatives from azo derivatives or azoxy derivatives, production.—E. H. Reichenberg and S. W. Reichenberg. May 12, 1934. 438,427.

WATER-SOLUBLE RHODIUM COMPOUNDS, production and use.—W. W. Triggs (Baker and Co., Inc.). May 12, 1934. 438,365.

ALDEHYDES of the indole series, manufacture.—I. G. Farbenindustrie. May 13, 1933. 438,278.

CELLULOSE, manufacture.—H. Dreyfus. May 16, 1934. 438,433-4.

CELLULOSIC MATERIALS, treatment.—H. Dreyfus. May 16, 1934. 438,435.

CELLULOSE AND CELLULOSIC PRODUCTS, production.—H. Dreyfus. May 16, 1934. 438,436.

ACID DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 17, 1933. 438,437.

PRODUCTS CONTAINING CHLORINATED RUBBER, manufacture.—I. G. Farbenindustrie. May 17, 1934. 438,441.

O-AMINOAZO DYESTUFFS, process for manufacture.—I. G. Farbenindustrie. May 18, 1933. 438,445.

UNSYMMETRICAL HEPTACARBOCYANINE DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 18, 1933. 438,449.

SENSITISING PHOTOGRAPHIC SILVER HALIDE EMULSIONS, process. I. G. Farbenindustrie. May 18, 1933. 438,450.

FERRUGINOUS SULPHIDE ORES, roasting.—D. Tyrer and Imperial Chemical Industries, Ltd. May 18, 1934. 438,451.

MORPHOLINE DERIVATIVES, manufacture.—E. I. du Pont de Nemours and Co. May 18, 1933. 438,452.

HETEROCYCLIC COMPOUNDS, manufacture.—A. Carpmael (I. G. Farbenindustrie). June 1, 1934. 438,211.

EXPLOSIVES, manufacture.—W. M. Burden, C. G. Jackson, J. N. Pring and G. Rotter. June 22, 1934. 438,218.

EXTRACTS OR ESSENCES OF COFFEE, chicory, cocoa and the like beverages.—S. V. Poultney. July 2, 1934. 438,280.

VINYL COMPOUNDS, manufacture and production.—Coutts and Co. and F. Johnson (legal representatives of J. Y. Johnson, deceased) (I. G. Farbenindustrie). July 9, 1934. 438,281.

COMBINATION OF SALICYLIC ACID and a calcium salt.—M. Wodlinger. July 21, 1934. 438,222.

PREVENTING SOAPS from becoming rancid, process.—V. Dabsch and J. C. Vredenburg. Nov. 24, 1933. 438,231.

CYCLIC α-CYANKETIMIDES and cyclic cyanketones, process for manufacture.—Schering-Kahlbaum A.-G. Nov. 18, 1933. 438,291.

STABILISING AQUEOUS BITUMEN EMULSIONS, process.—J. R. Geigy A.-G. Nov. 20, 1933. 438,162.

THROUGH DYEING LEATHER, especially chrome leather, process. J. R. Geigy A.-G. Dec. 7, 1933. 438,398.

SEPARATION OF ACETIC ANHYDRIDE from mixtures containing it, process and apparatus.—Usines de Melle. Dec. 12, 1933. 438,399.

AMMONIUM CYANIDE, production.—G. Siegle and Co. and W. König. May 10, 1934. 438,402.

PURIFICATION OR RECLAIMING of used or waste paper.—Deutsche Hydrierwerke A.-G. Jan. 31, 1934. 438,403.

IRON-CHROMIUM ALLOYS.—B. Vervoort. March 9, 1934. 438,179.

HEXAMETHINE DYESTUFFS, manufacture.—I.G. Farbenindustrie. May 18, 1933. 438,484.

MORDANT DISAZO DYESTUFFS, manufacture.—Durand and Huguenin A.-G. March 5, 1934. 438,314.

CRYSTALLISATION OF DEXTROSE.—International Patents Development Co. Aug. 24, 1934. 438,244.

ERGOT PREPARATION, and process of obtaining it.—E. Lilly and Co. March 17, 1934. 438,486.

REFINING MINERAL, VEGETABLE, OR ANIMAL OILS, paraffins, waxes, resins and the like, process.—Planktokoll Chemische Fabrik Ges., and J. B. Carpzow. March 26, 1935. 438,185.

MONOAZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 9, 1934. 438,406.

READILY SOLUBLE COMPLEX THEOPHYLLINE COMPOUNDS, process for making.—P. R. Grüter. April 10, 1935. 438,408.

DEHYDRATING OIL-CONTAINING MATERIALS, apparatus.—Ges. Zur Verwertung Fauth'scher Patente. May 14, 1934. 438,410.

BITUMINOUS CONSTRUCTIONAL MATERIALS, manufacture.—J. R. Geigy A.-G. May 11, 1934. 438,188.

ELECTRODEPOSITION OF NICKEL.—Harshaw Chemical Co. Feb. 14, 1935. 438,412.

INCREASING THE VISCOSITY OF TARS, process.—C. A. Agthe. May 16, 1934. 438,413.

SINTERED HARD ALLOYS, manufacture.—Wolfram and Molybdaen A.-G. May 23, 1934. 438,414.

INCREASING THE VISCOSITY OF TARS, process.—C. A. Agthe. May 16, 1934. 438,415.

CELLULOSE ACETATE FILAMENTS and threads, manufacture.—British Celanese, Ltd., H. Dreyfus, R. W. Moncrieff, and F. B. Hill. Feb. 12, 1934. 438,584.

COMPOUNDS of the cyanine type, production.—J. D. Kendall. May 8, 1934. 438,420.

AMINES, manufacture and production.—I. G. Farbenindustrie. May 18, 1933. 438,793.

WHITISH SILVER IMAGES in photographic gelatine silver halide layers, production.—W. W. Groves (I. G. Farbenindustrie). March 19, 1934. 438,595.

IMPROVING THE RESISTANCE to corroding agents of aluminium base alloys, process.—I. G. Farbenindustrie. June 9, 1933. 438,512.

SUBSTITUTED AMIDES of aliphatic-aromatic acids, manufacture. A. G. Bloxam (Soc. of Chemical Industry in Basle). May 15, 1934. 438,659.

CARBOCYANINE DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 16, 1933. 438,603.

CONVERTING CARBON MONOXIDE into formic acid and its aluminium, chromium, and iron salts, process.—C. Ammon. May 18, 1934. 438,796.

VINYL ESTERS, manufacture.—I. G. Farbenindustrie. May 20, 1933. 438,728.

DERIVATIVES OF CHRYSENEQUINONES, manufacture and production.—Coutts and Co. and F. Johnson (I. G. Farbenindustrie). May 23, 1934. 438,609.

COMBUSTIBLE GASES and particularly coal distillation gases, purification.—W. C. Holmes and Co., Ltd., C. Cooper and D. M. Henshaw. June 2, 1934. 438,734.

HYDROCARBONS, purification.—Coutts and Co. and F. Johnson (I. G. Farbenindustrie). June 2, 1934. 438,810.

OBTAINING MOTOR SPIRIT and lubricating oils from rubber, gutta percha and similar materials, processes.—C. M. Cawley and J. G. King. June 5, 1934. 438,811.

COMPOSITIONS AND ARTICLES containing organic derivatives of cellulose.—H. Dreyfus. Feb. 19, 1934. 438,540.

PROTECTIVE TREATMENT of metals and alloys.—H. T. Davies. Aug. 13, 1934. 438,816.

ALKALI AND ALKALINE-EARTH METAL NITRATES, production.—Atmospheric Nitrogen Corporation. Aug. 12, 1933. 438,541

WATER-RESISTANT BODIES consisting mainly of calcium hydroxide, production.—Mining and Industrial Works. March 12, 1934. 438,676.

POLYMERISATION PRODUCTS of acetylene, manufacture and production.—Coutts and Co., and F. Johnson (I. G. Farbenindustrie). Sept. 21, 1934. 438,548.

β-BROMETHYLBENZENE, process for manufacture.—L. S. E. Ellis. (Soc. des Usines Chimiques Rhone-Poulenc). Sept. 25, 1934. 438,820.

POWDERED METALS, production.—General Electric Co., Ltd., R. W. Rees and C. J. Smithells. Oct. 12, 1934. 438,552.

ACYL OCTAHYDRO FOLLICLE HORMONES, manufacture.—Schering-Kahlbaum A.-G. Nov. 9, 1933. 438,753.

PRODUCING IRON ALLOYS of non-ferrous metals, process.—Krupp Grusonwerk A.-G. Dec. 14, 1933. 438,633.

CYCLIC PROCESS for the removal of oxides of sulphur from waste gases.—W. C. Anderson. June 26, 1935. 438,582.

Applications for Patents

(November 14 to 20 inclusive.)

METALLIC CARBIDE, manufacture.—E. Allen and Co., Ltd. 31811.

ESTERS OF METHACRYCLIC ACID, application.—H. J. Barrett, E. I. du Pont de Nemours and Co. and D. E. Strain. 31579, 31580.

DISTILLING APPARATUS.—H. Pilmore-Bedford. 32166.

CONVERSION PRODUCTS of azo dyestuffs containing metal in complex union, manufacture.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 32157.

PHOSPHORIC ACID ESTERS from flavines, manufacture.—A. Carpmael (I. G. Farbenindustrie). 32058.

POLZAZO DYESTUFFS, manufacture.—A. Carpmael (I. G. Farbenindustrie. 32210.

MEANS FOR DYEING FIBROUS MATERIALS with vat dyestuffs.—J. A. Carp's Carenfabrieken Naamlooze Vennootschap. (Holland, Oct. 2.) 31763.

RED AZO DYESTUFFS, manufacture.—Chemical Works, formerly Sandoz. (Switzerland, Nov. 21, '34.) 31908.

AZO DYESTUFFS, manufacture.—Chemical Works, formerly Sandoz. (Switzerland, Nov. 22, '34.) 31909.

VAT DYESTUFFS, manufacture.—J. E. Cole and E. I. du Pont de Nemours and Co. 31913.

THERAPEUTICALLY ACTIVE SUBSTANCES, production.—A. Coulthard and Imperial Chemical Industries, Ltd. 31697.

MEANS FOR BLEACHING by hydrogen peroxide.—R. B. Elliott and J. S. Reichert. 31912.

TEMPORARY, ETC., SOLIDIFICATION OF LIQUIDS, method of producing.—J. de Granville. 31555.

POLYNUCLEAR CYCLIC ALCOHOLS, manufacture.—W. W. Groves (Switzerland, Nov. 16, '34.) 31798.

BENZENE DERIVATIVES containing halogenated methyl-groups, manufacture.—W. W. Groves (I. G. Farbenindustrie). 31694.

KETONES OF POLYCYCLIC HYDROAROMATIC COMPOUNDS, manufacture.—W. W. Groves. 31928.

BENZALDEHYDES containing trafluoro-methyl-groups, manufacture.—W. W. Groves. 32156.

CARBONISATION OF FUEL.—Humphreys and Glasgow, Ltd. 32165.

RENDERING HYGROSCOPIC SALTS non-hydroscropic, process.—O. Hannach. 31725.

ACID WOOL DYESTUFFS of the anthraquinone series, manufacture. I. G. Farbenindustrie. (Germany, Nov. 16, '34.) 31736.

KETONES OF POLYCYCLIC HYDROAROMATIC COMPOUNDS, manufacture.—I. G. Farbenindustrie. (Germany, Nov. 17, '34.) 31929.

POLYMERISATION PRODUCTS, manufacture.—I. G. Farbenindustrie. (Germany, Nov. 20, '34.) 32158.

POLYMERISATION PRODUCTS, manufacture.—I. G. Farbenindustrie. (Germany, Dec. 22, '34.) 32159.

MONOAZO DYESTUFFS, manufacture.—Imperial Chemical Industries, Ltd., and A. H. Knight. 31914.

FIBROUS ANIMAL MATERIAL.—Imperial Chemical Industries, Ltd. 32213.

TEXTILE FABRICS, ETC., treatment.—Imperial Chemical Industries, Ltd. 32214.

APPARATUS FOR CONTROLLING THE FLOW of fluid material.—International Latex Processes, Ltd. (United States, Nov. 16, '34.) 31536.

AZO DYESTUFFS, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 31535.

MEANS OF SEPARATING EMULSION of oil, water, and solid substances.—G. W. Johnson (I. G. Farbenindustrie). 31896.

CONDENSATION PRODUCTS, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 32026.

RUBBER MIXTURES stable to light, preparation.—G. W. Johnson (I. G. Farbenindustrie). 32175.

DYESTUFFS, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 32176.

STERILISING, ETC., apparatus.—Manlove, Alliott and Co., Ltd. 31817.

PROMOTION OF RECRYSTALLISATION OF REFRACTORY OXIDES.—B. Moore. 31490.

FIRE-RESISTING HYDROCARBONACEOUS MATERIAL.—H. H. Robertson Co. and J. H. Young. 31756.

CARBOXYLIC ACIDS or derivatives containing the pyridine nucleus, manufacture.—Soc. of Chemical Industry in Basle. (Switzerland, Nov. 24, '34.) 31797.

PROMOTION OF RECRYSTALLISATION OF REFRACTORY OXIDES.—Thermal Syndicate, Ltd. 31490.

LEAD SODIUM ALLOY.—W. W. Triggs (E. I. du Pont de Nemours and Co.). 31867.

(November 21 to 27 inclusive.)

CELLULOSE ESTERS, ETC., manufacture.—E. Berl. 32376.

SULPHURIC ACID, manufacture.—E. Berl. 32377.

NITRATION OF CELLULOSE, ETC., process.—E. Berl. 32378.

RECOVERY OF SULPHURIC ACID, ETC., from water-soluble acid tars, process.—E. Berl. 32379.

CINCHONA ALKALOID DERIVATIVES.—C. L. Butler, H. L. Cretcher, W. L. Nelson, and A. G. Renfrew. 32884.

MORPHOLINE ETHANOLS, production.—Carbide and Carbon Chemicals Corporation. (United States, Dec. 4, '34.) 32262.

MIXTURE OF COAL GAS and water-gas, production.—H. H. Carey, A. T. Kent and Woodhall-Duckham (1920), Ltd. 32816.

CYCLOPENTENOPHENANTHRENE DERIVATIVES, manufacture.—A. Carpmael (I. G. Farbenindustrie). 32477.

ALKALI METAL NITRATES, production.—Coutts and Co. (I. G. Farbenindustrie). 32619.

CARRYING OUT EXOTHERMIC REACTIONS, apparatus.—Distillers Co., Ltd., H. Langwell, C. B. Maddocks, and J. F. Short. 32454.

ETHYLENE OXIDES, manufacture.—Distillers Co., Ltd., and H. Langwell. 32455.

OLEFINE OXIDES, manufacture.—Distillers Co., Ltd., H. Langwell, C. B. Maddocks and J. F. Short. 32456.

ALKYL CHLORIDES, manufacture.—E. I. du Pont de Nemours and Co. (United States, Nov. 22, '34.) 32472.

ORGANIC MERCURY COMPOUNDS, manufacture.—E. I. du Pont de Nemours and Co. (United States, Nov. 23, '34.) 32473.

MINERALS, ETC., separation.—C. L. Gerety. 32372, 32373.

DYESTUFFS OF THE ANTHRAQUINONE SERIES, manufacture.—W. W. Groves (I. G. Farbenindustrie). 32422.

HYDROCARBON COMPOUND for use as motor fuel, treatment.—W. Hassard. 32518.

CONDENSATION from substitution products of 2.3-hydroxynaphthoic acids, manufacture.—I. G. Farbenindustrie. 32793.

MONOAZO DYESTUFFS, manufacture.—Imperial Chemical Industries, Ltd. 32347.

HYDROCARBONS and their derivatives from mixtures of hydrogen and oxides of carbon, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 32423.

AMINO ALCOHOLS of quaternary aromatic-aliphatic ammonium bases, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 32424.

COMPOUNDS OF THE ANTHRAQUINONE SERIES, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 32745.

MONOAZO DYESTUFFS, manufacture.—A. H. Knight and F. Lodge. 32347.

PACKING BISULPHATE, process.—L. Lowenstein. 32313.

RECOVERY OF ALUMINIUM from scrap foils, etc.—C. C. Lunniss. 32253.

SALTS, production.—Norsk Hydro-Elektrisk Kvælstafabtieselskab. (Norway, Oct. 31). 32877.

DISPERSIONS OF METALLIC NAPHTHENATES, production.—H. L. Parsons. 32248.

OZONE, production.—E. J. Quain and J. R. Quain. 32610.

POLYMERISATION OF VINYL COMPOUNDS.—Röhm and Haas A.-G. (Germany, Dec. 31, '34.) 32915.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Austria.—An agent established at Vienna wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of materials for cosmetics. (Ref. No. 494.)

Norway.—A firm of agents established at Oslo wish to obtain the representation, on a commission basis, of United Kingdom manufacturers of resin, alum and chemicals generally, for use in the paper making industry. (Ref. No. 496.)

Bolivia.—A United Kingdom firm in Oruro desires the representation of a firm of wholesale druggists. (Ref. No. 497.)

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt as specified in the last available Annual Summary, is also given marked with an *—followed by the date of the Summary, but such total may have been reduced.)

TEASEL, LTD., London, S.E., chemical agts., etc. (M., 7/12/35.) Reg. Nov. 22, series of £5,000 debs., present issue £500; general charge.

Satisfactions

MOND NICKEL CO., LTD., London, S.W. (M.S., 7/12/35.) Satisfactions reg. Nov. 25, of deeds reg. Aug. 19, 1925, Feb. 13, 1928, and Oct. 5, 1932.

Receivership

NITRO-CELLULOSE EXPLOSIVES CO., LTD. (R., 7/12/35.) C. F. Saffery, of 200 Gresham House, Old Broad Street, London, E.C., ceased to act as receiver on Nov. 21, 1935.

Reduction of Capital

IMPERIAL CHEMICAL INDUSTRIES, LTD. (R.C., 7/12/35.) Order of the High Court of Justice, Chancery Division, dated November 13, 1935, confirming the reduction of the capital of the above named company from £95,000,000 to £89,565,859, and the Minute approved by the Court showing, with respect to the capital of the Company, as altered, the several particulars required by the above mentioned statute, were registered by the Registrar of Companies on November 25, 1935.

Prices of Chemical Products

Current Market Conditions

PRICES of chemical products remain as reported in THE CHEMICAL AGE last week (pages 502-503), with the exception of the items mentioned below. All grades of boric acid have been advanced by 30s. per ton as from December 1, and there have been increases in the prices of a number of coal tar products. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

LONDON.—Demand for the majority of chemical products continues quite satisfactorily, and a considerable volume of contract business for 1936 has been put through. The British makers advise that prices for sodium sulphide, all grades, and hyposulphite of soda continue unchanged for 1936. Contracts are being arranged for bichromate of soda and potash for the first six months of 1936 at present prices. There is a good, steady inquiry for all coal tar products, but stocks are scarce. Prices remain unchanged from last week.

MANCHESTER.—Price conditions on the Manchester chemical market this week have continued firm pretty well all round. Makers are repeating contract quotations for most of the leading classes of heavy products for delivery over next year. This has been contrary to expectations in some quarters, for there was a feeling that slight advances in a number of materials would be seen. Traders are now reporting a fair flow of contract orders over varying periods and activity in this respect during the next fortnight is likely to continue. In addition, there has been a moderate aggregate business made up of orders for near delivery dates. Lancashire users of chemicals are taking fair quantities into consumption, and the call for bleaching and dyeing products is maintained at about its recent level. The market for the by-products is firm generally and buying interest in the light materials as well as in the naphthalenes is active.

SCOTLAND.—There has been a better demand for chemicals for home trade during the week, and also rather more inquiry for export. Prices generally continue steady at about previous figures with only slight changes to report. Contract prices for several chemicals, including bichromate of potash and bichromate of soda have now been announced for delivery up to June, 1936, on same basis as at present.

General Chemicals

ACID, ACETIC.—LONDON: Tech., 80%, £35 5s. to £37 5s.; pure 80%, £39 5s. to £41 5s.; tech., 40%, £20 5s. to £22 5s.; tech., 60%, £29 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech., 80%, £38 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

AID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, £28; powdered, £29.

LEAD ACETATE.—LONDON: White, £36 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36 10s.; brown, £34 10s.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39

POTASSIUM PRUSSIATE.—LONDON: Yellow, 8½d. to 8¾d. per lb. SCOTLAND: Yellow spot, 8½d. ex store. MANCHESTER: Yellow, 8¾d.

SULPHATE OF COPPER.—MANCHESTER: £14 17s. 6d. to £15 per ton f.o.b.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 6¾d. to 7½d. per lb.; crude, 60's, 1s. 11½d. to 2s. 2½d. per gal. MANCHESTER: Crystals, 7½d. per lb.; crude, 2s. 6d. per gal. SCOTLAND: 60's, 2s. 6d. to 2s. 7d.

NAPHTHA.—Solvent, 90/100%, 1s. 5½d., to 1s. 6½d. per gal.; 95/160%, 1s. 7d.; 90/190%, 1s. to 1s. 1d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £10 10s. per ton; purified crystals, £14 5s. per ton in 2-cwt. bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 70s. to 75s.

PYRIDINE.—90/140%, 5s. 6d. to 8s. per gal.; 90/180, 2s. 3d.

TOLUOL.—90%, 2s. 4d. per gal.; pure, 2s. 9d.

XYLOL.—Commercial, 2s. 3d. per gal.; pure, 2s. 5d.

PITCH.—Medium, soft, 35s. to 36s. per ton, in bulk at makers' works. MANCHESTER: 42s. 6d. East Coast.

Company News

English China Clays.—A dividend has been declared on the cumulative preference shares at the rate of 7 per cent. per annum, less tax, for the half-year ended June 30, 1935, payable on December 20, 1935.

Griffiths Hughes Proprietaries.—An interim dividend of 5 per cent., less tax, is announced, payment of which will be made on January 31 next. This is the same as that paid last year, when a final dividend of 10 per cent. was paid accompanied by 2½ per cent. cash bonus.

W. and T. Avery.—An interim dividend of 5 per cent., less tax, is announced on the ordinary shares, payable on January 1. A similar payment last year was followed by a final dividend of 10 per cent. As shareholders then also received a share bonus of 20 per cent., the present distribution is payable on an ordinary capital increased by £142,363, to £840,788.

Canadian Celanese.—The company has declared on the 7 per cent. cumulative participating preferred stock a quarterly dividend of $1.75 per share for the three months period to December 31, 1935. An accounting for participating dividend on the preferred stock will be made after the accounts for the calendar year are made up and audited, which it is stated, will be some time in February. For 1934 a participating dividend of $1.91 per share was paid.

Tate and Lyle, Ltd.—The gross profits for the year to September 30 last amounted to £1,363,140 compared with £1,304,687 in the previous twelve months. After raising the allocation to general reserve from £150,000 to £310,000, the net balance is £123,926 higher at £954,793. The final dividend of 14 per cent., subject to tax, makes a total distribution of 18.2857 per cent. on the capital as increased by the 40 per cent. share bonus last April. In 1933-34 the dividend was 22½ per cent. The carry-forward is increased from £43,341 to £56,234.

Broken Hill South.—The net return from the mining section rose from £139,543 to £255,869 during the year to June 30 last, and investment income increased by £5,970 to £86,641, making a total net profit of £342,510, in comparison with £220,214 in the previous twelve months. Dividends totalling 6s. paid during the year absorbed £240,000, and, after providing £20,000 for plant and development, there is a balance of £307,329 to go forward, against £221,560 brought in. To mark the fact that this year the South Mine has been worked for fifty years the directors have decided to distribute a special Jubilee bonus of 2s. 6d. per share (12½ per cent.), to be an addition to, and paid with, the next quarterly distribution to be declared in January and paid in March next.

Sulphide Corporation.—For the year to June 30 last the net profits are £46,711 higher at £92,347 after amortisation and maintenance. The dividend on the preference shares is raised from 2½ per cent. to 10 per cent., and dividends are resumed on the ordinary shares, after an interval of five years, with a payment of 2½ per cent. A sum of £9,000 is appropriated to reserve for contingencies and £12,097 is carried to accumulated profit account. The report points out that the balance-sheet is presented this year entirely in sterling. In order to effect this, it has been necessary to use £138,087 of the sundry specific reserves to reduce to sterling the value of those items which were shown in Australian currency in last year's balance-sheet.

Turner and Newall.—After providing for depreciation, directors' fees and tax, the net trading profit, subject to audit, for the year to September 30 last, is £780,625, compared with £714,228 in the previous year. The final dividend on the £4,843,933 ordinary stock is 10 per cent., making 12½ per cent. for the year. This is the highest distribution since 17½ per cent. was paid in 1928-29. The total payment last year was 10 per cent. It is proposed to transfer £100,000 to general reserve, increasing this fund to £1,000,000. No reserve allocation was made a year ago, but a special appropriation of £94,349 was made to write down book value of subsidiary companies' assets conveyed to Turner and Newall. The staff pension fund again receives £10,000. The carry-forward is reduced from £130,513 to £94,548.

From Week to Week

THE KIDWELLY TINPLATE WORKS, believed to be the oldest in the country, on December 2 restarted four of its seven mills, and about 350 of the full complement of 420 men were engaged.

THE MELLON INSTITUTE OF INDUSTRIAL RESEARCH has just issued a booklet entitled "The Municipal Smoke Problem." It is attractively written by H. B. Meller and L. B. Sisson, and offers several solutions to a much-discussed nuisance.

THE CUNARD-WHITE STAR LINE has just placed an order with the Vacuum Oil Co., Ltd., for the whole of the lubricating oil requirements for the main propelling machinery of the new liner "Queen Mary." The first delivery of over 20,000 gal. for the initial requirements will be made on December 23.

MR. STANLEY, president of the International Nickel Co., of Canada, announced in Toronto on Monday that £1,200,000 was to be spent on the construction of new plant. This, he added, was necessary owing to the continued increase in the consumption of nickel. The work will take about a year to complete.

SEVERAL MEN WERE TEMPORARILY BLINDED by creosote, and one was taken to hospital, when an explosion occurred at Redcar works on December 2 at the Warrenby benzol plant coke ovens. A workman said that the explosion was felt all over the works. Many windows were shattered, and metal frame-work was twisted. The men had their faces covered with creosote, and had marvellous escapes from serious injury.

WORK ON THE CONSTRUCTION of the new coke oven plant, by-product plant and coal washery at Monkton, Jarrow, for John Bowes and Partners, Ltd., is to begin early in January. Already the site is being prepared by Koppers Coke Ovens, Ltd., of Sheffield. The plant will cost £250,000 and use 200,000 tons of coal per annum. The Birtley Company, Co. Durham, are to carry out the major part of the scheme.

THE NEW CATALOGUE of British precision balances and weights which L. Oertling, Ltd., have just issued is an attractively produced publication in two quarto volumes, one dealing with chemical balances and the other with assay balances. It includes illustrations and specifications of an enormously wide range of fine precision instruments. Copies will gladly be sent on request to any industrial or educational laboratory.

A FURTHER STAGE is announced in the struggle for increased efficiency between the producers of power units and of the fuel they use. Fifteen years ago Mr. H. R. Ricardo, an expert in internal combustion, patented two alcohol fuels for motor racing. They were then far in advance of the demands of any engine then in use. Now they are used in practically every track-racing event—for cars and cycles—in the kingdom; higher compression ratios and supercharging have made their anti-knock and cool-running qualities particularly valuable. Next year these fuels as well as other racing fuels associated with the name of the Distillers Co., Ltd., will be on sale to the ordinary motorist, under the name of "Cleveland Ricardo Discol," at the same price as ordinary petrols.

AN OLDHAM TEXTILE MACHINERY FIRM has for more than a year been perfecting machinery for preparing flax for spinning with cotton under a secret process invented by a Canadian chemist. Part of the flax which was previously a waste product has now been made into a valuable raw material. From this can be made a strong linen-like fabric which takes dye as well as the best linen. In the ordinary practice of the Irish linen industry flax is immersed in water for a fortnight to separate the useful from the useless fibres. Under the new process it is converted into a spinnable fibre mixed with cotton within 25 hours. The resultant yarn is cheaper than cotton of equivalent grade. It is expected that production on a considerable scale will soon begin in Lancashire, providing employment for many idle mills.

IT IS UNDERSTOOD THAT the new Corpach Factory near Fort William, to be built by the British Oxygen Company, is to produce carbide calcium, which at present is not made in the British Isles, but is largely imported from Norway. Carbide was formerly produced at Foyers, on the shores of Loch Ness. Surveys of lime-producing areas in the district are at present being undertaken.

THE REPORT of the Atlas Steel Foundry and Engineering Co., Ltd., Armadale, shows a profit of £12,145 for the year ended September. It has now been found possible to resume dividends with a payment of 7½ per cent. per annum. The directors state that there was a marked improvement in the demand for the company's production during the year, and prices also advanced.

GAS EQUIPMENT has been put into a new open-hearth steel-melting furnace completed at the Hallside Works, Newton, of the Steel Co. of Scotland, Ltd., and the furnace will start steel production as soon as the refractory hearth is burned in. Two additional furnaces are projected at a cost of £60,000. At present the main rolling mills are on restricted production due to lack of ingot steel, but contracts on hand will justify the introduction of the three-shift system.

WITH THE DANGER OF TANKS containing hundreds of gallons of oil exploding, Salford Fire Brigade, in positions from the roofs of abandoned houses, played hoses on the blazing premises of Thomas Briggs, tarpaulin manufacturers and oil refiners, of Mount Street, Salford, on November 29. The factory, a four-storey building, employs between 200 and 300 people at proofing oilskins and aeroplane fabric, and over 400 men had just left the building when the fire broke out.

THE WELL-KNOWN PAISLEY FIRM, J. and J. McCallum, Ltd., Laighpark Dyeworks, have acquired the three remaining sheds and ground previously belonging to Walter M'Gee and Sons, Ltd., engineers, and their purchase completes the sale of the ground and premises formerly occupied by that firm. The buildings are to be used for the extension of the dyeing, warehousing, and winding plant, while the ground will provide facilities for a new boiler installation equipped with the latest conveyor equipment for the coal and ash handling plant.

EXPERIMENTS have been conducted at the laboratories of the Manchester Committee on Cancer for four or five years into the medical aspects of Diesel fuel oils. Dr. C. C. Twort and Mr. J. M. Twort, the investigators, state in a paper published in "The Lancet" that the inquiry was undertaken because of the likelihood that in the relatively near future private motor cars would be driven by the high-compression internal combustion engine (the Diesel) and because apparently a few years will see the majority of the many thousands of motor omnibuses in service on the London streets propelled by the Diesel-type engine. Experiments undertaken with mice led them to the observation that the lighter-grade Diesel fuel oils are non-carcinogenic for the skins of the animals, but that a heavier grade tested was definitely carcinogenic.

MR. TOM WILLIAMS, M.P. for the Don Valley Division of Yorkshire, opened at a garage in Gloucester Terrace, London, on November 30, the first pump in the country supplying motorists with petrol made from coal. Mr. Williams said that last year Britain imported 2,752 million gallons of petrol, and it seemed to him that a considerable portion of that might very well be drawn from raw material in this country. We could not hope, he added, to supply the total needs of the R.A.F. and all the transport services, but if motorists wanted to help a depressed industry and their own national economy, they could not do better than use coal petrol. The R.A.F. had until now used all the petrol made from coal, and it was only recently that a surplus was available for motorists.

Forthcoming Events

LONDON

Dec. 9.—Institution of the Rubber Industry. "Patents and the Rubber Industry." Annual general meeting of London Section. H. Douglas Elkington. 7.30 p.m. 12 St. James's Square, London.

Dec. 9.—Institute of Brewing (London Section). Joint meeting with the London Section of the Incorporated Brewers' Guild. "Some Brewery Problems through the eyes of a Chemical Engineer." M. B. Donald. 6 p.m. Horse Shoe Hotel, Tottenham Court Road, London.

Dec. 10.—Pharmaceutical Society of Gt. Britain. "International Biological Standards for Drugs and Therapeutic Substances." Dr. Percival Hartley. 8.30 p.m. 17 Bloomsbury Square, London.

Dec. 11.—Institution of Chemical Engineers. "The Textile Finishing Trades, from a Chemical Engineering Standpoint." J. E. Howarth. 6 p.m. Burlington House, Piccadilly, London.

Dec. 11.—British Gas Federation. Annual Dinner. 7 p.m. Grosvenor House, London.

Dec. 12.—The Institute of Vitreous Enamellers. "Heat Resisting Alloys." J. Ferdinand Kayser. 8 p.m. British Industries House, Marble Arch, London.

Dec. 12.—Institute of the Plastics Industry (London Section). "The Expanding Aircraft Industry and Its Possible Uses for Plastics." Discussion opened by C. C. Walker. 7.45 p.m. British Industries House, Marble Arch, London.

Dec. 12.—Institute of Metals (London Section). "Diecasting of Non-Ferrous Alloys." N. F. G. Robertson. 7.30 p.m. 83 Pall Mall, London.

Dec. 12.—Institute of Fuel. "The Production of Lubrication Oil from Coal Products." Professor Alfred W. Nash. 6 p.m. Burlington House, Piccadilly, London.

Dec. 13 and **14.**—Borough Polytechnic, London. Exhibition of Students' Work. Friday 6 to 9 p.m., and Saturday 4 to 9.30 p.m. Borough Polytechnic, Borough Road, London.

BIRMINGHAM

Dec. 9.—Chemical Society. "The Decomposition of Molecules by Light." Dr. R. G. W. Norrish. 5 p.m. University, Birmingham.

Dec. 12.—Society of Chemical Industry (Birmingham Section). "The University Department of Industrial Hygiene and its Relation to the Chemical Industry." Dr. H. E. Collier. 7.30 p.m. University Building, Edmund Street, Birmingham.

CARDIFF

Dec. 13.—Society of Chemical Industry (South Wales Section). Joint meeting with the Institute of Chemistry. "The Chemist and Safety in Industry." J. Davidson Pratt. 7.15 p.m. University College, Cardiff.

EDINBURGH

Dec. 10.—Institution of the Rubber Industry (Scottish Section). "Factory Welfare." J. B. Longmuir. 7 p.m. Chamber of Commerce Rooms, Edinburgh.

Dec. 12.—Institute of Chemistry and Society of Chemical Industry (Edinburgh Sections). "Works Hygiene and Accident Prevention." Dr. W. G. Hiscock. 7.30 p.m. North British Station Hotel, Princes Street, Edinburgh. Annual General Meeting of the Institute. 7 p.m.

GLASGOW

Dec. 11.—Alchemists' Club. "The Formation of Anthocyanins in Plants." Professor R. Robinson. 7.30 p.m. University, Glasgow.

Dec. 13.—Oil and Colour Chemists' Association (Scottish Section). "Recent Developments in Paint Technology." E. J. Bond. 7.30 p.m. Glasgow.

LEEDS

Dec. 9.—Society of Chemical Industry (Yorkshire Section). "Synthetic Rubber." Dr. W. J. S. Naunton. 7.15 p.m. University of Leeds.

LEICESTER

Dec. 11.—Leicester Literary and Philosophical Society. "Impurities in Chemicals." Dr. P. F. R. Venables. 7.30 p.m. College of Technology, Leicester.

LIVERPOOL

Dec. 10.—Chemical Society. "Formation on Anthocyanins in Plants." Professor R. Robinson. 6 p.m. University, Liverpool.

Dec. 12.—Institute of Chemistry (Liverpool Section). Social. Liverpool.

MANCHESTER

Dec. 12.—Institute of Brewing (North of England Section). "Oxidation, Reduction and Brewing." Dr. I. A. Preece. Midland Hotel, Manchester.

Dec. 13.—Joint meeting of Oil and Colour Chemists' Association, the Literary and Philosophical Society, and Society of Dyers and Colourists (Manchester Section). "Vat Dyestuffs containing only Carbon, Hydrogen and Oxygen." Dr. R. Fraser Thompson. 7 p.m. Reynolds Hall, Manchester.

NEWCASTLE-ON-TYNE

Dec. 10.—Institute of Metals (North-East Coast Local Section). "The Manufacture and Uses of Powdered Metals." J. C. Chaston. 7.30 p.m. Armstrong College, Newcastle-on-Tyne.

Dec. 13.—Society of Chemical Industry (Newcastle Section). Joint meeting with Plastics Group. "Physical Properties of Some Synthetic Plastics." Dr. A. Caress. 7.30 p.m. Chemistry Lecture Theatre, Armstrong College, Newcastle-on-Tyne.

Dec. 14.—North of England Institute of Mining and Mechanical Engineers. General meeting of members. 2.30 p.m. Newcastle-on-Tyne.

NOTTINGHAM

Dec. 13.—Institute of Fuel (East Midland Section). Joint meeting with the Society of Chemical Industry. "Compressed Gas as a Fuel for Motor Transport." R. Cook. 7 p.m. University College, Nottingham.

OTTAWA

Dec. 10.—Society of Chemical Industry (Ottawa Section). "The Bio-Chemistry of Condensed Ring Systems." Dr. D. L. Thomson. Ottawa.

SHEFFIELD

Dec. 10 and **11.**—Society of Glass Technology. Dec. 10. 5 p.m. Glass Standards Committee. 7 p.m. Informal Dinner. 8.30 p.m. Committee No. V. 8.30 p.m. Joint meeting of Furnace Committee and Refractories Committee. King's Head Hotel, Sheffield. Dec. 11. 9.45 a.m. Council Meeting. King's Head Hotel. 12.30 p.m. Informal Luncheon. King's Head Hotel. 2 p.m. Ordinary General Meeting. "Resistant Glasses for Modern Electric Discharge Lamps." J. H. Partridge; "Analysis of Some Glasses for Modern Electric Discharge Lamps," R. C. Chirnside; "A Study of Volatilisation of Lead Oxide from Lead Oxide-Silica Glasses," E. Preston and Professor W. E. S. Turner. The University, Darnall Road, Sheffield.

Dec. 13.—Institute of Metals (Sheffield Section). "The Adhesion of Electro-deposited Nickel." A. W. Hothersall. 7.30 p.m. University, Sheffield.

STOKE-ON-TRENT

Dec. 9.—The Ceramic Society (Pottery Section). "Some Notes on Pottery Plaster." A. Heath. 7.30 p.m. North Staffordshire Technical College, Stoke-on-Trent.

SWANSEA

Dec. 10.—Institute of Metals (Swansea Section). "Welding." L. C. Percival. 6.30 p.m. Y.M.C.A. Swansea.

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